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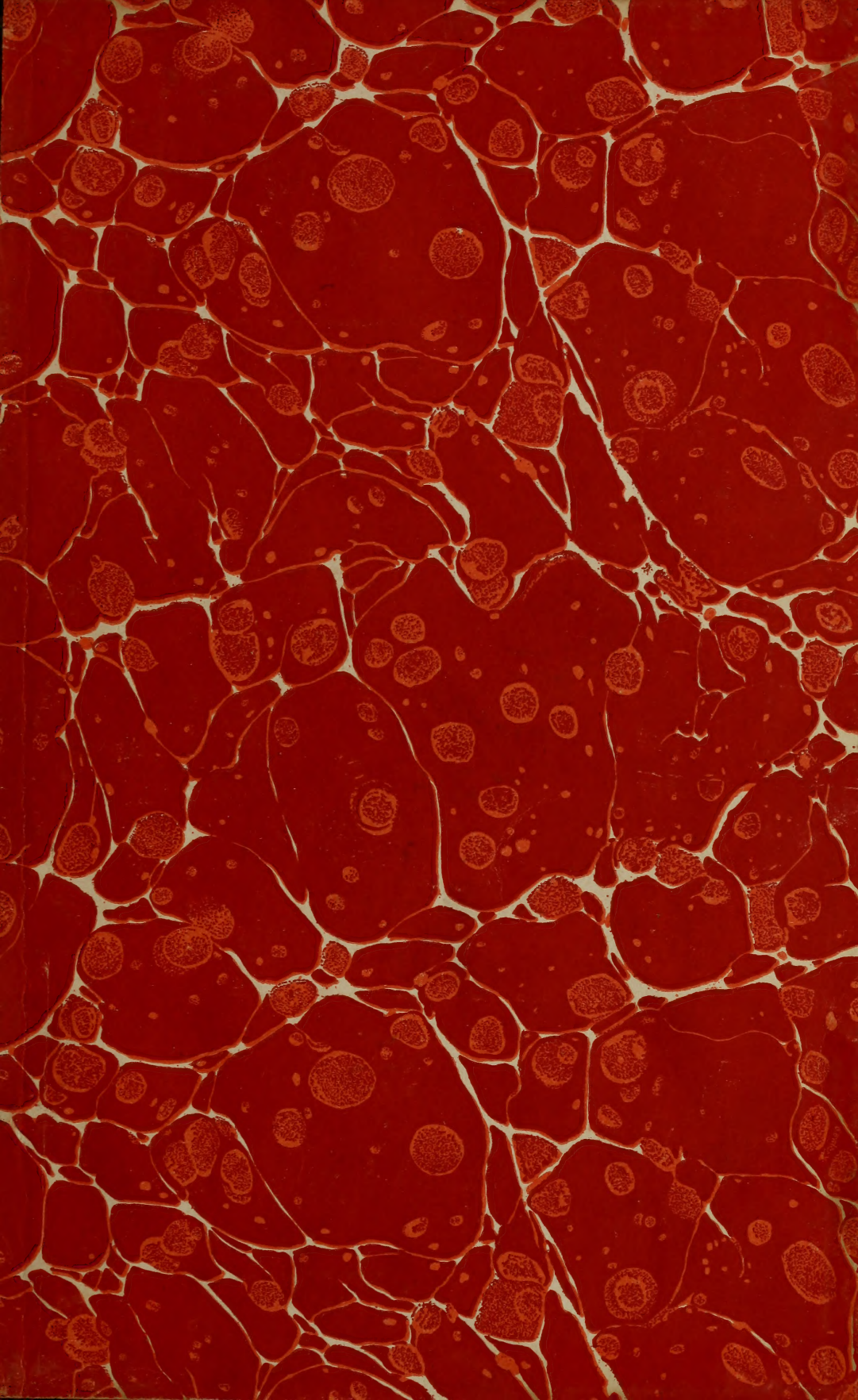


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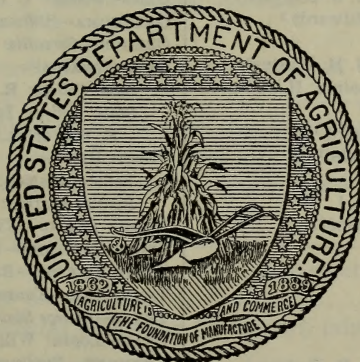


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No. 1

Adhering to its traditional policy of meeting in alternate years in Washington, the Association of Land-Grant Colleges again assembled in this city for its thirty-eighth annual convention, held from November 12 to 14, 1924. The choice of the Nation's Capital as a meeting place proved felicitous. In addition to the usual helpful contacts of a Washington meeting, the association program for the first time in its history included an address by the President of the United States, who thus by his presence and his words manifested his appreciation of the work of the institutions represented and his sympathies with their purposes and ideals.

The convention was attended by over two hundred delegates and a considerable number of visitors. The registration showed representatives from every State, and in nearly half of the institutions complete delegations for the subdivisions of agricultural instruction, research, and extension, home economics, and engineering. In about three-fourths of the States the delegations were headed by their presidents, by far the largest proportion for many years. The stations were also well represented, the only directors or vice directors not registering being those from Florida, Mississippi, Montana, Nevada, and Ohio.

The number of organizations meeting at substantially the same time as the association was much smaller than formerly. The American Society of Agronomy held a largely attended and thoroughly successful meeting, and the American Association for the Advancement of Agricultural Teaching presented an interesting program. The informal dinners of station directors, college and university presidents, extension directors, and home economics and engineering heads again proved pleasant social occasions.

The convention program was in general conformity with those of recent years, with three general sessions, two meetings of the executive body and an informal conference of presidents, and two-day programs of the sections of home economics and engineering. The section on agriculture held parallel half-day sessions of its divisions of resident teaching, experiment stations, and extension, and three joint sessions dealing with questions pertaining to the interests of each of the divisions in turn.

The first two general sessions, shifted from evening to afternoon at the 1923 convention, were restored to their customary place in the evening. Despite many evidences of careful planning, considerable variation was again noted in the sessions as regards fullness of program, some groups finding ample opportunity for discussion and others a good deal of congestion. The evening sessions in particular were quite protracted. On the other hand the final general session was so abbreviated as to permit the executive body to meet immediately at its close and complete its work at an earlier hour than for many years. The whole situation was considered by the executive body, and the incoming executive committee was requested in the formulation of the 1925 program to discourage over-long papers at the general sessions and to provide greater opportunity for discussions from the floor.

The address of President Coolidge attracted wide public notice and was naturally the outstanding event of the convention. The President discussed the prevailing agricultural situation in some detail, and he emphasized quite specifically the opportunities before the land-grant colleges for leadership, stating that he looked upon these institutions "as the group in whose hands rests a greater responsibility for the destiny of American agriculture than can fairly be attributed to any other single body." He went on to express the view that these colleges are concerned in contributing in every possible way to making a better rural civilization. "Your efforts," he said, "comprehend all the problems of better farming methods, of larger and cheaper production, of conserving all resources of the soil, of more efficient marketing, of better homes, better rural schools, better places of religious worship, and more intimate and helpful neighborly kindness among the people of the open country. They look to wise and intelligent cooperation in all the business operations which affect the farmer, so that wasteful and unnecessary processes may be eliminated. They contemplate the establishment of a closer contact, a better understanding, a more sympathetic and helpful relationship, between the people of the farms and those of the cities and the industrial areas."

The President drew attention to the far-reaching economic changes under way, predicting that "in the lives of many who are now among us" the United States is likely to become one of the world's greatest buyers of agricultural products. Hitherto, as he pointed out, history has shown that agriculture has tended to discouragement and decadence when the predominant interest of a country turns to manufacture and trade. The land-grant college, in his opinion, would prove the main great agency for the preven-

tion of such a development and for the maintenance of "a prosperous, self-reliant, confident agriculture."

The central theme of the convention was this fundamental question of the special responsibilities of the land-grant colleges and the lines along which their development should be directed. It was the subject of the presidential address delivered by President Pearson of Iowa and subsequently discussed as regards agriculture by President Knapp of Oklahoma, mechanic arts by Dean Hitchcock of Ohio, and home economics by Doctor Stanley of the Bureau of Home Economics of the U. S. Department of Agriculture.

President Pearson outlined as among the matters needing particular attention from the colleges the development of a system of permanent agriculture, the conservation and proper use of the natural resources, more and better instruction in citizenship, and a thorough study of the scope and work of the land-grant institutions. Regarding the last of these he pointed out that the situation throughout the country is very different from what it was when the first Morrill Act was passed, and that "we now should have a study of the basic laws and the whole problem with a view to show how to eliminate the least desirable, reduce that which is least profitable, and magnify that which is best suited to the purposes these institutions should serve. There is good precedent in the recent study of medical education which was financed by Rockefeller funds and has resulted in greatly strengthening education in medicine. Already engineering education is being investigated by a group of engineering educators, and the work is being financed by Carnegie funds. This leaves agriculture and home economics education especially in need of such a study as is proposed. Ample funds should be secured for this purpose, and the work should not be done hurriedly."

Whatever may be thought as to the need or the practicability of such a survey as President Pearson evidently had in mind, it reflects a very apparent desire of the institutions themselves to render their most effective service. From this point of view it is most encouraging, indicating an attitude far removed from complacent self-satisfaction or a disposition to rest on the oars.

Should such a survey be attempted, much would depend upon the machinery through which it would be carried on. One plan was put forward at the convention in the report by Dean Vivian of Ohio for the special committee on objectives in college instruction in agriculture. This committee recommended, as a result of its year's deliberations, the establishment of a permanent standing committee on which the colleges of agriculture, experts in job analysis, the Federal Board for Vocational Education, and the U. S. Department of Agri-

culture would be represented, and whose function would be the carrying on of a comprehensive survey of the field over a period of years and including cooperative studies with the colleges of agriculture. While no formal action was taken by the executive body on this question, the interest manifested would seem to point to the probability of the ultimate provision of detailed studies in some form.

In the division of resident instruction two papers were presented which still further discussed the situation. One of these by Dean Kyle of Texas took up the building of an agricultural curriculum to meet present-day needs. This paper referred to the decrease in the enrollment of agricultural students in many colleges and indicated that what is especially needed is a clear understanding on the part of the colleges of their function in training leadership for agriculture, giving proper weight to economic phases of the industry and educating the public as to the importance of an agricultural education and the opportunities for graduates. In this connection it was believed that entrance requirements should be raised, trade courses eliminated, and all subcollegiate work turned over to Smith-Hughes, Smith-Lever, and other agencies.

The second paper in the group, entitled Capitalizing an Agricultural College Education, led to conclusions similar to those brought out by Dean Kyle. Its author, Director Haskell of Massachusetts, referred to the difficulties encountered by agricultural graduates in actual farming through a lack of capital and the frequent necessity of competing against the unpaid family labor system followed by immigrant farmers with a lower standard of living, the general increase of knowledge of better farming methods acquired through the free teachings of the extension service, and the unfavorable rate of exchange prevailing between the products of the farm and other commodities. Such considerations, of course, greatly influence the answering of the much mooted question as to how far the function of the agricultural college should be the training of prospective farmers.

Several concrete suggestions as to a delimitation of the field were made by the committee on instruction in agriculture, mechanic arts, and home economics. This committee reported through its chairman, Dr. A. C. True, regarding the status of short courses, defining these courses as the systematic instruction in a subject or group of subjects of shorter duration than a four-year college course and not leading to a degree. The committee recommended the abandonment of all work of this type which is of secondary grade as soon as other agencies are available, and it even regarded the retention of the more advanced courses of from one to three years as of doubtful expediency.

A report presented to the executive body by a special committee on institutional classification suggested that the association proceed to set up minimum requirements for the bachelor's degree in agriculture, and that for the corresponding task with regard to engineering and home economics the services should be enlisted of the Society for the Promotion of Engineering Education and the American Home Economics Association. This report was accepted by the executive body as to agriculture, but amended for the remaining subjects by substituting as the proper agencies the engineering and home economics sections of the association.

Still another plea for a reassessment of institutional values and objectives was made by President Thompson of Ohio in an address entitled *The Nature and Strength of the Leadership That Ought to Characterize Agricultural Colleges under Present Conditions*. In his usual vigorous fashion, President Thompson argued for a training much broader than the mere technique of production, a training which would embrace economic and social relationships and would prepare in the fullest sense for citizenship.

The policy followed at recent meetings of stimulating interest in the improvement of the quality of college teaching through addresses by authorities in pedagogic methods was continued. A talk on modern problems in education was given before one of the joint sessions of the section on agriculture by Prof. W. H. Kilpatrick of Teachers College, Columbia University, and a second address later by the same speaker on *Relative Values in Education*. A paper before the division of resident teaching by Prof. M. F. Miller, entitled *Some Results from Applying the Principles of Job Analysis to Agricultural Teaching*, set forth the experiences of the faculty of the College of Agriculture of the University of Missouri in a study at informal faculty seminars held several times during the school year of their own teaching methods. It is quite evident that interest in this important matter is steadily increasing, and that distinct improvement in the quality of the instruction is being made.

The comparatively new problem of providing vocational guidance for students was presented in some detail by Deans Freeman of Minnesota and Farrell of Kansas. In the opinion of the former, "educational departments could make no more significant nor valuable contribution to agricultural education generally than in the classification and analytical study of all the vocations and professions in the whole field of agriculture." Dean Farrell also indorsed the idea that the entire subject should be studied scientifically so that it may be dealt with systematically and objectively.

Another field to which much attention has been given in recent programs is that of economics, and in this respect the 1924 convention was no exception. The joint session of the section on agricul-

ture assigned to research was devoted entirely to economics papers, Director Cooper of Kentucky discussing experiment station leadership in economic problems, Dr. E. G. Nourse the significance of prevailing European conditions to American farmers, and Dr. R. T. Ely the relation of land valuation to our agricultural future. Two papers were also given before the extension division on cooperative marketing, and the economic and social aspects of research in home economics found consideration in that section. Of related interest was a paper by Dr. C. J. Galpin entitled *Spending the Dollar Wisely for Home and Community*.

The address of Director Cooper referred to the nation-wide demand and hope among farmers that the experiment stations will present "the same leadership in the broad economic field which they have so patently exerted in the field affecting production." He mentioned the recent establishment of private foundations and other agencies for the study of economic questions, maintaining that "the question of the economic development of agriculture, the steps which should be taken to meet shifting demands, their relationships or the relationship to industry and finance, organization, and legislation are much too important to be left to individuals or groups, irrespective of their worthiness of purpose. This will occur unless experiment stations exert to the full extent their leadership in the economic field. . . . Research is the only vehicle by which agriculture may avoid the rough and often disappointing road of experience. It will serve as the foundation for the development of an economic policy which is as essential to the farmer to-day as a livestock policy, a cropping policy, or any other program of betterment."

In accordance with the usual custom, the general sessions were further enlivened by a number of miscellaneous papers. Of these special mention should be made of the inspiring address of Dr. Eugene Davenport, who discussed as the needs for success in technical fields other than research and education such elements as a knowledge of men, an adequate philosophy of life, and native ability, and indicated how the colleges could help in developing these essentials for leadership. Opportunity was also given for a description of the research, extension, and regulatory activities of the Federal Department of Agriculture through brief accounts by Directors Ball and Warburton and Solicitor Williams, the last-named representing Director Campbell. A paper by E. E. Hunt of the U. S. Department of Commerce on Waste Elimination in Industry outlined the campaign which is being made by the Government in this direction. Similarly, Col. W. B. Greeley of the Forest Service described to the section on agriculture some of the recent developments in the conservation of natural resources, especially from the forestry viewpoint.

The annual bibliographical report as presented by Doctor True took the form of a partial index to the proceedings of the association itself since its organization. Such an index has been long needed, and its preparation will greatly facilitate ready reference to the many matters with which the association has dealt during its long history.

A distinct note of sadness permeating the convention proceedings was occasioned by the death of Secretary Wallace, who had accepted the customary invitation to participate in the program. Opportunity was afforded, however, for the President, the Department of Agriculture, and the association itself to pay tribute to his memory at one of the general sessions. A notably sympathetic address of appreciation was delivered on this occasion by his successor, Secretary Gore.

Brief tributes were also paid to the memory of the late President Riggs of South Carolina, for many years one of the outstanding figures in the association and at his death engaged in its service as a member of its executive committee. The principal address was given by President Lory of Colorado, who spoke appreciatively of the career of President Riggs and his services to Clemson College and the land-grant colleges of the Nation.

The interests of research received sympathetic consideration, although perhaps they were less conspicuously in the foreground than at some previous conventions. Progress reports were received as to the status of pending Federal legislation to increase the funds of the stations and broaden their work, and the details of this legislation, especially in its relations to home economics, were under discussion at several sessions.

The experiment station division presented an interesting program and attracted an excellent attendance of directors. The principal business was the presentation of committee reports and papers on the familiar subjects of the scope and functions of the station reports and the formulation of experimental or research projects. A notable feature was the ample opportunity presented and utilized for discussions.

No report was made by the joint committee on projects and correlation of research, but Director Lipman reported for the joint committee on publication of research, Director Thatcher for the committee on experiment station organization and policy, and Director Dodson for the special committee on the status of the Purnell bill. Director Lipman reported that the *Journal of Agricultural Research* for the current year had accepted 278 contributions, of which 60 were from the stations, a somewhat smaller proportion than usual. As classified by subjects, the largest number of papers continued to

be in plant pathology and mycology, followed in order by entomology and insecticides, chemistry and animal physiology, plant physiology, genetics, and soils and fertilizers.

The report of the committee on experiment station organization and policy dealt mainly with the proposed code of ethics for station workers. A revised draft of the tentative code presented in 1923 incorporating changes which had been suggested by the various stations was submitted. From the discussion which followed it appeared that objections previously raised had been largely remedied in the revision, and the code was adopted by the section. While it was made plain that no binding rule or administrative regulation for the individual institutions could be made in this way, it was felt that much good might follow the adoption of the code as a statement of what is regarded by the group as a professional standard of conduct.

The committee also called attention to the importance of conducting correspondence concerning the use of the station frank and similar matters in which legal questions or interpretations may arise through the Office of Experiment Stations rather than directly with the various branches of the Federal Government. It was pointed out that rulings or orders vitally affecting the business of all the stations have sometimes resulted from the decision of points raised by individual officers, and that the presentation of such matters could commonly be made in a more orderly and more effective fashion through a central office taking up the question in a broad way than by an individual station or its officers.

The status of the station report was discussed by Assistant Director Morrison of Wisconsin, directors of several other stations, and Dr. E. W. Allen, Chief of the Office of Experiment Stations. Although the topic has frequently appeared in the association's programs, much diversity of viewpoint as to what these reports should contain was again revealed. In practice, great variation in treatment exists, ranging from a brief and somewhat formal administrative report including the organization list, the financial statement, and similar data and issued in very small editions to comprehensive detailed accounts sometimes supplemented by reprints of the other station publications of the year or frequently made up in popular form for wide distribution. Advocates were not found wanting for most of these various forms, and there seemed to be little trend toward standardization, particularly in view of the legal requirements in numerous States. There was substantial agreement, however, that the report should be a record of stewardship so far as this is a matter of public interest. It should not be merged with reports of instruction or extension work, and, in general, it need not be encumbered with departmental reports. The value of including lists of the station projects and of the publications of members of

the staff in outside journals was brought out, but the fitness of the report as a medium for presenting results of investigations was seriously questioned. Concerning its value in bringing the station work prominently before the public, there were some differences of opinion.

Administrative problems in the handling of research projects were taken up by Director Farrell and several others. The need of sufficient supervision to keep the work moving was indicated, although it was made clear that this should not be carried to a point which would chill initiative. The possibilities of cooperation in research projects, changing their direction, or closing out projects when necessary were also considered.

The presidency of the association was bestowed upon President Woods of Maryland. This created a third vacancy in the executive committee in addition to those previously occasioned by the death of President Riggs and the resignation of Dean Mann. One of these vacancies was filled by the return of President Pearson to the committee and the others by the elections of President Hetzel of New Hampshire and Director Lipman of New Jersey. President Morgan of Tennessee was elected vice president, and Dean Hills of Vermont reelected secretary-treasurer. A complete list of the officers and of the changes in committees has been noted in the December issue of the *Record*.

No final decision was reached as to the place of holding the 1925 meeting, some strength developing for Kansas City and San Francisco, as well as for Chicago, which had been tentatively favored by the executive body. The matter was left with the executive committee.

Taken as a whole, the 1924 convention was a very harmonious gathering, with few outstanding issues and comparatively little business of a controversial nature before it. This seemed to be due in no sense to an avoidance of such matters, but rather to the absence at this time of pronounced differences of opinion. The attitude of the convention was progressive, as was indicated by its disposition to make certain that the land-grant colleges were discharging their full responsibilities. The needs of research seemed to be well understood, and there were many evidences of a desire to obtain for it more liberal financial support as speedily as possible. The various sections presented strong and helpful programs, and the general sessions were stimulating and constructive. The address of President Coolidge, as already pointed out, was of great public interest and significance, and will doubtless be the event longest remembered in the years to come.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

The chemistry of milk and dairy products viewed from a colloidal standpoint, L. S. PALMER (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 631-635).—This contribution from the Minnesota Experiment Station consists of a general discussion of the more important colloidal problems of milk and dairy products, with particular reference to some of the recent advances in this field. A bibliography of 33 titles is appended.

Some factors concerned in the autoxidation of fats, with especial reference to butter fat, G. R. GREENBANK and G. E. HOLM (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 598-601, figs. 2).—The course of autoxidation or the autocatalytic oxidation of fats under varying conditions was followed by exposing pure butterfat, alone and subjected to various treatments, to oxygen with rapid stirring and measuring the absorption of oxygen at definite periods of time. The oxygen absorbed was plotted against the time in hours.

Two definite periods are noted in the curves obtained: (1) The period of induction during which there is but little absorption of oxygen, little or no loss of color, only a faint tallowy odor, and a faint Kreis test, and (2) the period of logarithmic absorption in which there is rapid absorption of oxygen accompanied by bleaching, a tallowy odor, and a pronounced Kreis test. One of the factors influencing the length of the period of induction was found to be the presence of water or water vapor. This not only retarded the oxidation but also the development of the tallowy odor. The addition of fatty acids to butter tended to hasten the catalytic action, the higher acids having a greater effect than the lower. Oleic acid, which had a much greater effect than butyric, is thought to owe its strong catalytic power to the ease of oxidation of its double bond. The more rapid oxidation of old than of fresh butter is explained on the ground of slight hydrolysis with the liberation of acids, particularly oleic, from the glycerides.

Of various methods of treating fats to prevent oxidation, steam distillation and thorough washing were found to be the most satisfactory. It is noted, however, that the steam treatment should not be continued too long. "There may be similar changes if washing is prolonged, but undoubtedly to a very slight extent. Heat seems to be an important factor in the preparation of a good quality butterfat by the steam distillation process.

"The fact that the keeping quality of butterfat can be so materially increased by subjecting it to a process which removes the fatty acids is of great practical importance, not only from the standpoint of the butter-oil industry, but also from the point of view of butter manufacturers and manufacturers of oils and fats. The foregoing experiments indicate the importance of the use of sweet cream in the manufacture of butter for storage, and indicate also that a thorough washing of any fat that is to be held in storage is not only advisable but necessary when excellent keeping quality is desired."

Clarification of yeast extracts with neutral lead acetate, F. W. REYNOLDS (*Indus. and Engin. Chem.*, 16 (1924), No. 6, p. 562).—The method previously described (E.S.R., 51, p. 112) has been modified further by using neutral lead acetate in amounts just sufficient to produce a flocculent, easily filtered precipitate. The filtered extract is then dialyzed or washed on an ultrafilter to complete the purification. The amount of lead acetate required is given as 15 gm. per liter for top yeast and 35 gm. for bottom yeast.

Attention is called to the fact that the lead precipitate washed free of soluble material with distilled water may be used as a filtering medium for the removal of the turbidity or opalescence which sometimes develops in yeast extracts after concentration and washing on an ultrafilter.

Pectin and its hypothetical precursor "protopectin," F. TUTIN (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, pp. 91-96).—Previously noted from another source (E. S. R., 50, p. 310).

Ethylene glycol—its properties and uses, H. C. FULLER (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 624-626).—Attention is called to possible uses of ethylene glycol as a solvent and preservative in food and drug industries.

Insulin and its manufacture, F. H. CARR (*Jour. Soc. Chem. Indus.*, 43 (1924), No. 29, pp. 228T-234T, figs. 4).—This paper deals chiefly with the adaptation of the original laboratory method of making insulin to its large-scale manufacture in England. A diagram is included showing graphically the successive steps in the continuous process employed.

Condenser for distilling oils of wide boiling range, H. N. CALDERWOOD, JR. (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 576, 577, fig. 1).—The apparatus described consists of a condenser tube 1,100 mm. in length fitted with three Liebig jackets, each 250 mm. in length. The jacket nearest the outlet end is connected with the water tap, and the middle one with a 300 mm. Liebig condenser set up vertically with its lower end connected with the lower tube of the middle condenser and the upper end with the upper tube of the condenser. This condenser is filled with water or a suitable liquid which is kept in circulation through being heated in the course of the distillation. The upper condenser is connected with an air supply for the initial air cooling of the distillate.

Through the cooling of the vapors in three stages, the apparatus is said to make possible in a single uninterrupted operation the distillation of materials with a wide boiling range.

A simple turbidiscopes, W. D. HORNE and E. W. RICE (*Indus. and Engin. Chem.*, 16 (1924), No. 6, p. 626, fig. 1).—The source of light in the turbidiscopes described is a nitrogen-filled, concentrated-filament, incandescent lamp bulb hung in a closely fitting tin cylinder extending a little above the top of the lamp and about 1 cm. below the filament. About 1 cm. below this cylinder is fastened by soldered wires a second cylinder about half the height of the first. Both cylinders are painted black inside and out to prevent dispersion and deflection. Around each cylinder is an annulus perforated with holes of the right size for the test tubes to contain the sample and standard solutions. These are supported on a broader annulus at the base. In use, the solution is placed in one of the tubes and compared with tubes containing known amounts of fine material in suspension.

Determination of nitrate nitrogen: A colorimetric method, F. M. SCALES and A. P. HARRISON (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 571, 572).—The method described, which is said to be applicable to the determination of small amounts of nitrate nitrogen in biological solutions, is based on the Denigès color test with reduced strychnine (E. S. R., 26, p. 511). Directions are given for the preparation of this reagent and the technique of the proced-

ure. Among the advantages claimed for the test are that, on account of the high sensitivity of the reagent, interference from colored extracts may be eliminated by dilution, that only a small quantity of the sample is needed, and that chlorides do not interfere with the test.

Testing milk and its products, E. H. FARRINGTON and F. W. WOLL (*Madison, Wis.: Mendota Book Co., 1924, 26. ed., rev. and enl., pp. VI+280, pl. 1, figs. 63*).—This is the twenty-sixth edition of this work (E. S. R., 24, p. 514).

Physical tests of flour quality with the Chopin extensimeter, C. H. BAILEY and A. M. LE VESCONTE (*Cereal Chem., 1 (1924), No. 1, pp. 38-63, fig. 1*).—This paper, which should be consulted in the original, contains a brief review of the literature on various instruments which have been devised to test flour quality, a translation by the junior author of a paper by M. Chopin¹ on the Relation Between Physical Properties of Dough Samples and Bread, in which an apparatus called an extensimeter is described, and the report of the use of this apparatus in the examination of doughs prepared under different conditions and from flours treated in various ways. The principle upon which the apparatus is based is that a simple and general relation exists between the power which a flour dough possesses of being stretched into a thin membrane and the specific volume of bread which can be obtained with it. The stretching power or extensibility of a flat disc of dough prepared under standard conditions is measured by the volume of air inclosed at the moment of breaking.

In the tests reported, the effect of various factors upon the extensibility of dough was investigated with the following results:

"Prolonged mechanical treatment or mixing of a dough decreases the extensibility, probably because of an increase in the degree of dispersion of the colloidal particles. Water added to ordinary bread dough tends to make it more extensible and less tenacious and more easily stretched. After reaching an optimum absorption, the dough becomes less extensible. Starch mixed with a flour decreases the extensibility of the dough appreciably, indicating that the quantity of gluten in a flour is an important factor in determining flour strength.

"H-ion concentration is a factor in determining the extensibility of dough. At an approximate pH 6, the dough is most extensible, and below a pH 5 or above a pH 7, the extensibility is greatly lowered.

"Chlorine treatment of the flours tends to decrease slightly the elasticity of the dough, probably because it increases the H-ion concentration, although it may be of value in increasing the baking value because of accelerated enzyme activity.

"Flour improvers are primarily yeast foods and do not necessarily increase the strength of a flour. Calcium acid phosphate tends to increase the extensibility of a dough, phosphoric acid decreases it only slightly in the proportions used.

"The Chopin extensimeter readings afford a useful index of the extensibility of a dough and are of value as an indication of the strength or baking value of a flour, giving in one simple and rapid test the result of the several factors that may affect the extensibility."

The physico-chemical properties of strong and weak flours.—VIII, Effect of yeast fermentation on imbibitional properties of glutenin, P. F. SHARP and R. A. GORTNER (*Cereal Chem., 1 (1924), No. 1, pp. 29-37, fig. 1*).—The experimental work reported in this continuation of the series of studies previously noted (E. S. R., 51, p. 803) was carried out in connection with studies of

¹ Bul. Soc. Encour. Indus. Natl. [Paris], 133 (1921), No. 3, pp. 261-273.

Collatz on the production and disappearance of sugars in dough during yeast fermentation (E. S. R., 49, p. 12). Samples of the various doughs in this study were used for the determination of imbibitional properties of the glutenin.

Yeast was found to produce a marked change in the imbibitional properties of the glutenin during fermentation. The viscosity of a suspension prepared from the dough with electrolytes removed and following treatment with lactic acid increased as fermentation progressed. Malt flour and malt extract decreased the imbibitional power of the glutenin during fermentation. As fermentation progressed it became impossible to wash the gluten from the dough. These results are thought to indicate that yeast exerts a marked effect on the gluten during the period of normal fermentation.

A viscosimetric study of wheat starches, O. S. RASK and C. L. ALSBERG (*Cereal Chem.*, 1 (1924), No. 1, pp. 7-26, figs. 2).—A technique has been developed for determining in a Stormer viscosimeter the viscosities of starch pastes at 90° C. and at concentrations ranging from 2.85 to 5.75 per cent. The technique is described, and data are reported on its use in the examination of starch obtained from 11 flours milled from unblended wheat grown in the different wheat-producing sections of the United States. Chemical and baking studies of the same flours are also reported. The principal conclusions drawn from the study are as follows:

"With one possible exception, wheats were observed to divide themselves according to their growing habits when arranged in the order of their gelatinized starch paste viscosities, starches of the winter wheats having the higher viscosities and those of spring wheats the lower. Durum wheat is not considered in this scheme of division.

"The highest viscosities of gelatinized starch pastes prepared from durum and Kansas hard red winter wheats suggest the possibility that the superior macaroni-making qualities of products of these wheats may be due to their starches as well as to their proteins. It may be possible, therefore, to supplement present methods for evaluating the macaroni-making qualities of a flour by a viscosity determination of its starch paste.

"High starch viscosity was observed to be associated with two or more of the following conditions in the case of each flour: (1) Low loaf volume, (2) low protein content, and (3) high temperature of locality of growth. Low viscosities were observed to be similarly associated with the opposite conditions."

The removal of gummy, oily, and waxy matters from raw cane sugar, C. M. KEYWORTH and R. B. FORSTER (*Jour. Soc. Chem. Indus.*, 43 (1924), No. 27, pp. 203T-206T).—As a method for removing gummy and waxy material from raw sugar sirup, the authors suggest heating the sirup to boiling in vacuo and passing steam through the solution. The residual solution is then evaporated to its original density and is ready for the usual clarification. Experiments on a laboratory and commercial scale are reported, showing that the rate of filtration of the sirup through carbons such as Norit and Filter-Cel is increased by about 100 per cent by such treatment. It is stated that the optimum time for distillation varies with the sugar to be treated, but that from 30 to 60 minutes is usually sufficient if the live steam coil is of suitable proportions.

Starch in sorghum sirup, J. J. WILLAMAN and F. R. DAVISON (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 609, 610).—An investigation at the Minnesota Experiment Station of the cause of jellying in sorgho sirup has led to the conclusion previously reached by Sherwood (E. S. R., 50, p. 509) that starch is the primary cause of this phenomenon. Some true gum containing galactan was also found to be present.

Fruit products (*California Sta. Rpt. 1923, pp. 253-263, figs. 2*).—In a continuation by J. H. Irish of the work on fruit sirups (*E. S. R.*, 48, p. 507) the best results were obtained with pomegranates by pressing the whole fruit, heating the juice to coagulate the proteins, allowing it to settle for from 12 to 24 hours before filtering, and sweetening with cane sugar to 35° Balling. The sirup is said to be of a deep red color and of pleasing flavor.

Berries yielded the most satisfactory sirups when picked soft ripe and sweetened not to exceed 45° Balling.

Concentration of fruit juices by freezing and pouring off the liquid from the ice was found to give sirups of better flavor than that obtained by any other process. Deterioration of sirups during storage was found to be retarded by increasing the density of the sirups to about 70° Balling or by applying flash sterilization. A raisin sirup suitable for the preparation of carbonated beverages has been made by J. G. Brown by blending the raisin sirup with orange and lemon sirups.

Further studies by Irish have shown that infusorial earth either calcined or washed thoroughly with water to remove the earthy taste can be used satisfactorily as a clarifying agent.

The work on carbonated fruit beverages has been continued on a semi-industrial scale by Irish. Loganberry, raspberry, and orange beverages were the most popular and strawberry and pomegranate the least.

In further experiments by W. V. Cruess, J. H. Irish, et al. on the use of fruits in candy, it was found that a pleasing candy could be made by mixing various dried fruits with a heavy jam prepared from ground unpeeled oranges. Seeded Muscat raisins combined with orange pulp is recommended as a satisfactory material for centers for chocolate-coated candies. Satisfactory jelly centers for candies have been prepared by boiling 4 parts of any fruit juice, 1 part by volume of a concentrated pectin sirup such as Certo, and sugar equal in weight to that of the mixed juice and pectin sirup until the temperature reaches 225° F., pouring the liquid into depressions of suitable depth in dry powdered starch, and allowing it to solidify for 24 hours.

Difficulties in preventing canned raisins from fermenting have been overcome by sterilizing the raisins in sealed cans for 30 minutes at 212°. Fresh prunes have been canned successfully by dipping them in dilute boiling lye, canning in a light sirup (30° Balling), exhausting the filled cans for about 8 or 10 minutes in steam, sealing, and sterilizing for 30 minutes at 212°. In the canning of grapefruit, it has been found that the skins can be peeled very quickly and economically by the use of a 2 per cent boiling solution of lye.

A special study by A. W. Christie of the dehydration of prunes has shown that with the same quality of prunes dehydration results in a greater yield of a larger sized product than sun drying. A comparison of different temperatures and humidities has shown that the best quality can be produced by dehydration at a moderate temperature and humidity. Walnuts have been dehydrated successfully, using the time of 46 hours at 80°, 19 hours at 100, 16 hours at 110, and 11 hours at 120°. The progress of dehydration in the State is shown by comparison of statistics for 1921 and 1922. With the exception of pumpkins, which showed a decrease, there was a marked increase in all products, amounting to 2,640 per cent for peaches, 1,375 per cent for grapes, 353 per cent for prunes, 223 per cent for apricots, and 216 per cent for pears. At the University Farm certain improvements were made in the dehydrator, and 169 tons of fruit were dehydrated in a period of 40 days. A maximum temperature of 165° was used for apricots, prunes, and grapes, 155° for peaches, and 145° for pears.

In experiments conducted by E. H. Guthrie and C. E. Woodworth on the packaging of dried fruits and vegetables, it has been found that the optimum

moisture content for the development of insects in dried prunes and apricots is about 18 per cent. Moisture contents of 10 and 26 per cent prevented the development of the insects, but the latter content permitted the growth of mold in unsulfured fruits. Tin cans packed in vacuum and hermetically sealed have been found to preserve dried fruits in the best condition. Enameled cans are necessary with acid products, especially sulfured fruits.

Freezing fruit for by-product use (*California Sta. Rpt. 1923, pp. 194, 195*).—In experiments conducted by J. G. Brown under the direction of E. L. Overholser and W. V. Cruess, satisfactory results were obtained in the preservation of fruits and berries in a frozen condition.

Strawberries, blackberries, raspberries, loganberries, cherries, apricots, peaches, figs, and grapes stored with dry sugar or covered with sugar solutions did not lose their original color or flavor after being kept frozen at a temperature of 10° F. for six months. The texture of the fruits frozen in sugar solution was better after thawing than of those mixed with sugar alone or frozen in water. No appreciable changes took place in the chemical composition of the fruit. The frozen fruits were found satisfactory for making jams, jellies, preserves, pie filling, ice creams, and desserts. For use as pie fillers, berries, apricots, and peaches proved most desirable when crushed and mixed with an equal weight of sugar before freezing. For jams and preserves, berries were most satisfactory when kept whole and mixed with an equal weight of sugar before freezing, and apricots and peaches when stored in a 30 to 45 per cent sugar solution. For figs to be used for preserves, the freezing method proved cheaper and more satisfactory than the customary practice of canning them in water.

Making vinegar in the home and on the farm, E. LEFEVRE (*U. S. Dept. Agr., Farmers' Bul. 1424 (1924), pp. II+29, figs. 10*).—The methods described are classified as home, farm, and commercial methods. The home method is a simple process for making vinegar from surplus fruits such as peaches, pears, etc. The crushed fruit is inoculated with compressed yeast for alcoholic fermentation, and after this is complete (requiring from 4 to 6 days) the juice is separated from the mash, 1 part of vinegar is added to 4 parts of the juice, and the acetic fermentation allowed to proceed with frequent tests for acidity until the maximum acidity has been reached, when the vinegar is filtered and bottled. "Anyone who has a supply of surplus fruit, 2 or 3 large stone jars, a few cakes of compressed yeast, and 3 or 4 qts. of good vinegar to act as a starter can in this way make all the vinegar that is required by an ordinary family for a year. Vinegar with an acetic acid strength of 4.5 per cent has been made from peaches by this method in 13 days."

In the farm method the apple juice is allowed to stand for a day or two in covered receptacles and is then inoculated with yeast, 1 cake to 5 gals. Three methods of acetic fermentation are described, the slow barrel process, which is essentially the same as the household process; the continuous process, in which arrangement is made for drawing off the vinegar as formed and adding a new charge without breaking the surface film; and the rolling generator process. The commercial method or quick vinegar process makes use of the rapid generator described by Chace (*E. S. R., 48, p. 13*). For this process the use of pure starters for both alcoholic and acetic fermentation is recommended, and directions are given for their preparation.

The publication also contains directions for the after treatment of the vinegar, a discussion of causes of failure in vinegar making, a description of animal parasites with which vinegar may be infested, and descriptions of chemical tests for vinegar.

METEOROLOGY

The organization of agricultural meteorology (agricultural ecology) in Germany, P. HOLDEFLEISS (*Internatl. Rev. Sci. and Pract. Agr. [Rome]*, n. ser., 2 (1924), No. 2, pp. 265-271).—The partially developed decentralized system of collecting and digesting data regarding phenology and the relation of climate and weather to crops through questionnaires sent to various institutions and agencies in Germany is briefly described, and the importance of such service is explained. The objectives are in brief as follows: (1) To map the territory from the standpoint of agricultural meteorology, (2) to secure a more useful and reliable basis for forecasting crop yields, (3) to develop the possibilities of longer weather forecasts, and (4) to study evaporation in relation to plant and animal life.

Correlation between production of grain and rainfall in Sicily [trans. title], F. EREDIA (*Atti R. Accad. Naz. Lincei 5. ser., Rend. Cl. Sci. Fis., Mat. e Nat.*, 32 (1923), II, No. 10, pp. 358-361, fig. 1; rev. in *Nature [London]*, 113 (1924), No. 2847, p. 763).—This article reports a qualitative study, without computation of correlation coefficients, of the relation between yields of grain and annual and seasonal rainfall for the period 1909-1923.

"In Sicily, rainfall is negligible between June and September, and is small in April and May, but the crops are especially susceptible to variations in the fall of these two months. The major relationship brought out by the tables and diagrams is that, whereas years of scarcity are always those of low rainfall, the converse does not always hold, which points to an optimum quantity of rain, put . . . at 840 mm. (33 in.), above which rain is damaging. Certain discrepancies come out as between different districts of Sicily in connection with differences in agricultural methods and the use of manures, which tend to complicate the simple climatic influences."

The review in *Nature* expresses the opinion that "nothing would throw so much light on the important subject of agricultural climatology" as a geographic coordination of the results of the various studies of this kind which have been made in Great Britain, Sweden, and other countries.

Phenology and the possibilities of its application to agriculture, H. L. WERNECK (*Internatl. Rev. Sci. and Pract. Agr. [Rome]*, n. ser., 2 (1924), No. 1, pp. 13-21).—It is pointed out how phenology developed first as an auxiliary of botany dealing with species of wild plants growing in their natural habitat, and that its extension to cultivated plants has been slow and partial.

"Agricultural phenology takes as its lowest unit the race or variety of cultivated plants in their area of agricultural distribution. . . . Its task is to help to determine, from specific differences in growth and other characters, whether certain varieties of cereals, fruit trees, vines, vegetables, and forage plants are suited for cultivation in given districts. The more widely and generally artificially bred varieties are cultivated in districts where the growth-rhythm and the development-rhythm are different from those found in the plants' country of origin, the more indispensable becomes the knowledge of agricultural phenology if it is desired to obtain any special performance on the part of the variety, and especially if the object is to produce heavy crops under determined climatic conditions."

Agricultural phenology can also "be used to determine the country of origin of varieties, just as Scharfetter has employed botanical phenology in tracing the origin of wild plants," as explained in an article previously noted (E. S. R., 51, p. 717).

The character and agricultural consequences of the rainfall régime of Montpellier [trans. title], L. CHAPTAL (*Ann. Sci. Agron. Franç. et Étrangère*,

41 (1924), No. 1, pp. 28-38, pl. 1, figs 2).—The rainfall conditions of the region are summarized, diagrams being given which show the total annual rainfall, 1873-1922, and the yields of grapes, 1897-1922.

The mean annual rainfall for the 39 years was 733.51 mm. (28.88 in.), distributed as follows: Winter 182.28 mm. (7.18 in.), spring 186.29 (7.33), summer 125.62 (4.95), and autumn 238.79 mm. (9.4 in.). The average number of days of effective rainfall (over 4 mm. or 0.16 in.) per year was 93. It is explained that smaller rainfalls than this decrease rather than increase the soil moisture when the soil is very dry. While the total rainfall is high, it is not well distributed and often too intense to be well absorbed by the soil, especially in autumn. Moreover, the number of days of effective rain is rather low. It is maintained, however, that the soil derives a considerable amount of moisture from dew, fogs, and internal condensation of water vapor, and this in part makes up the deficit due to excess of evaporation and transpiration over precipitation. There appeared to be no simple relation between total annual rainfall and yield of grapes, and it is stated that the data furnish no evidence of periodicity in rainfall.

Brief reference is made to various means which have been proposed for modifying and conserving rainfall.

SOILS—FERTILIZERS

Report of the fourth annual meeting of the American Soil Survey Association (*Amer. Soil Survey Assoc. Rpt., 4 (1923), pts. 1, pp. [2]+93; 2, pp. [2]+94-162, pls. 7*).—The proceedings of this meeting are reported in two parts. They contain, in addition to reports of committees, special papers as follows:

Part 1.—The Future of the Soil Survey in Our National Agricultural Policy, by M. Whitney; Problems in the Mapping and Classification of Soils in Kent County, by G. N. Ruhnke; Field Methods for the Profile Study of Peat Deposits, by A. P. Dachnowski; Mapping the Swamp and Marsh Lands of Northern Michigan, by L. R. Schoenmann; Some Problems in Classification and Mapping Soils in Southeastern United States, by W. E. Hearn; Problems in Mapping and Classifying Iowa Soils, by P. E. Brown; Textural Problems in Mapping Glacial Soils, by H. G. Lewis; A Study of Native Vegetation as Related to Soil Classification, by W. T. Carter, jr.; Soils for the Landscape Gardener, by E. A. Kanst; Mapping Peat Soils, by W. E. Tharp; Application of Soil Classification to Forestry and Silviculture, by J. O. Veatch; The Importance of Mottled Colors in Soils, by G. W. Conrey; Utilization of the Soil Survey by Station and Extension Agronomists, by A. T. Wiancko; Soil Acidity Tests in Relation to Soil Classification, by S. D. Conner; Acid Studies in Illinois in Connection with the Soil Survey, by R. S. Smith; The Active Acidity of Soils, by E. T. Wherry (*E. S. R.*, 51, p. 617); Soil Acidity as Related to Soil Types in Missouri, by M. F. Miller and W. A. Albrecht; Relation of Soil Reaction to Crop Response to Liming, by C. O. Rost and E. A. Fieger; Relation of Soil Acidity to Soil Classification, by P. L. Gile; Acidity Tests on Soil Types in Michigan, by J. O. Veatch; Some Observations on the Relations of Acidity Tests and Soil Types, by T. M. Bushnell; and A Suggested Laboratory and Field Test for Soil Acidity, by P. Emerson.

Part 2.—The Soiltext Method for Testing for the Soil Reaction, by C. H. Spurway; The Value of Soil Survey as a Basis for Soil Studies and Soil Use, by M. M. McCool; The Value of the Soil Survey as a Basis for Soil Studies and Soil Use, by E. E. DeTurk; Utilization of the Soil Survey in the Teaching of Soils, by F. E. Bear; Some Experiences with the Thiocyanate Test for Soil Acidity,

by G. W. Conrey; How the Government Soil Survey of Each County Can Be Used for Practical Purposes, by C. A. Stanton; Color as a Factor in Soil Classification, by J. G. Hutton; Difficulties in Utilizing the Work of the Soil Survey, by A. R. Whitson; The Relation of the Soil Survey to the Settlement of the Unused Lands, by T. D. Rice; The Utilization of the Soil Survey in Planning Crops Experimental Work, by W. L. Burlison; Utilization of the Soil Survey in Crop Experimental Work, by C. A. Mooers; and A New Soil Acidity Test for Field Purposes, by E. Truog.

Soil survey of O'Brien County, Iowa, J. A. ELWELL and H. R. MELDRUM (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+213-246, fig. 1, map 1*).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 364,160 acres in northwestern Iowa. A gently rolling plain of loess covered drift characterizes all but the extreme eastern part of the county. The natural drainage varies from fair to good.

The soil materials are of glacial deposition modified in varying degrees by a surface deposit of loess. They have no relation to any underlying rock formations. Fifteen soil types of 12 series are mapped, of which the Marshall silt loam covers 72.8 per cent of the area.

Soil survey of Beadle County, South Dakota, W. I. WATKINS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+1475-1499, fig. 1, map 1*).—This survey, made in cooperation with the South Dakota College of Agriculture, deals with the soils of an area of 800,000 acres in east-central South Dakota. The greater part of the county lies within the prairie plains of the James River Valley. Drainage is said to be poorly established.

The soils of the county are derived from glacial drift, either weathered in place or transported and redeposited as glacial terraces or as recent alluvium. The drift is derived from granite, limestone, sandstone, and shale rocks, and it varies in thickness from a few feet to over 100 ft. Including swamp, 19 soil types of 7 series are mapped, of which the Barnes loam and silt loam cover 40.8 and 14.1 per cent of the area, respectively.

Analyses of soils of the Cattavia Valley, Island of Rhodes [trans. title], A. FERRARA and M. SACCHETTI (*Agr. Colon. [Italy], 17 (1923), No. 9, pp. 333-337*).—Physical, mechanical, and chemical analyses of five samples of soils typical of the valley lands in the southwestern extremity of the Island of Rhodes are presented and briefly discussed.

Some characteristics of the peat in the chalky valleys of northern France [trans. title], A. DEMOLON and V. DUPONT (*Compt. Rend. Acad. Sci. [Paris], 179 (1924), No. 1, pp. 72-74*).—Studies of the reaction of so-called acid peats from northern France showed that they are in fact only feebly acid as indicated by the electrometric method, having a pH value usually greater than 6. This value varied with the depth of the peat sample. The low acidity of these peats is attributed to the presence of water containing calcium bicarbonate, which includes from 200 to 250 mg. of calcium carbonate per liter. This results in a continuous neutralization of the acid substances formed by the decomposition of the vegetable debris. Since there is no intimate saturation of the peat with this water, the neutralization of the acidity is imperfect and a slight residual acidity persists.

A comparison of the actions of limewater and of a solution of calcium bicarbonate on this peat showed that treatment with the latter, followed by washing with distilled water, resulted in a nearly neutral reaction; while treatment with the former resulted in a much more intense fixation of lime and a markedly alkaline reaction. Treatment with a series of reagents including distilled water, 5 per cent sugar solution, 2 per cent carbollic acid, 5 per cent

ammonium chloride solution, and a saturated solution of carbon dioxide resulted in a progressive increase in the amount of lime dissolved out. This is taken to indicate that the lime fixed by peat in excess of that necessary to neutralize its acidity is combined in a form easy to dissociate.

A brief study of the mineral composition of peat leads to the conclusion that that fraction of the ash in excess of 7 per cent of the dry peat should be considered as of external origin, and consists of fixed lime and of a small quantity of argillaceous matter retained by the peat.

[Soil studies at the California Station] (*California Sta. Rpt. 1923, pp. 234-237, figs. 2*).—A continuation of studies by E. V. Winterer on the percolation of water through soils (E. S. R., 48, p. 512), in which soils of different texture were studied under different heads of water and percolation was continued for periods ranging from 150 to 275 days, showed that the presence of a water table does not decrease the rate of percolation, and that an increase in head results in a greater loss by percolation and is not dependent upon the time that the head of water is increased.

The rate of percolation through a gravelly phase of a sandy loam is about twelve times greater than through loam, all other things being equal. There is a striking similarity between all of the percolation curves, with a decrease in flow followed by a second maximum and then a gradual diminishing of the flow. The variations in the rate of percolation are dependent upon the effective head operating on the soil column, which varies according to the dispersion of the soil colloids, the loss or gain of organic material, the gradual silting up of the pore spaces of the soil, and the loss of colloidal and fine clay material in the drainage water.

The amount of colloidal material leached out of the soil varies directly with the rate of percolation. The effective head varies with the flow of water at any point in the soil column and is dependent upon time. The hydraulic gradient in a column of soil with a head of water operating upon its surface is not a straight line but a uniform curve, which in about 10 days approaches a straight line for the soil used. A dilute solution of copper sulphate increases the rate of percolation by altering the soil structure. An increase in the rate of percolation may be also obtained with a dilute solution of formaldehyde.

Studies by Winterer on the mechanical composition of rice soils are said to have resulted in the development of a method similar to that used by Odén. The method depends upon the relation existing between the diameter of the particles and the rate of fall through a liquid. The particles are weighed continuously and automatically as they fall on a pan arranged near the bottom of a cylinder containing the clay particles in suspension in a liquid. By mathematical calculations, and the use of Stoke's law, it is possible to determine the size and distribution of the particles. In one soil the smallest size measured had a diameter of 0.00004 mm.

[Soil moisture studies at the California Station] (*California Sta. Rpt. 1923, pp. 156, 157*).—Studies of the movement of moisture from moist to dry soils by F. J. Veihmeyer at Mountain View showed that the maximum movement either upward or downward from the moist soil into the dry soil was less than 7 in. during a period of 4.5 months.

Further studies by Veihmeyer on the accuracy of moisture equivalent determinations indicated the extreme care necessary to obtain a definite quantity of soil in the centrifuge boxes.

The composition of the soil solution as indicated by the displacement method (*California Sta. Rpt. 1923, pp. 174-176, fig. 1*).—A modification of the Parker displacement method for obtaining the soil solution is explained by J. C. Martin and J. S. Burd, and progress results are reported.

It is stated that, aided by positive air pressure never exceeding 100 lbs. per square inch and using distilled water as the displacing medium, solutions have been displaced from closely compacted columns of soils having a constant concentration, the volume being from 50 to 80 per cent of the original moisture in the soil. The concentrations of solutions displaced from the same soil at different moisture contents are inversely proportional to the total moisture. When the displaced solution from a soil was used as the displacing agent on another column of the same soil at the same moisture content, the displaced solution was identical with the displacing agent, and the latter passed through the soil unchanged, indicating that the displaced solution has the same concentration and composition as the solution with which it came in contact in the soil.

Comparisons made between displaced solutions and the water extracts of the same soils at the same moisture content indicated that either method gave the same concentration of nitrate and chloride, and both showed very similar concentrations of calcium and magnesium. The extraction method in every case indicated a higher concentration of potassium and phosphoric acid than was present in the displaced solution. In the case of the latter the excess was directly proportional to the excess water used in extraction.

The concentration of phosphate in the soil solution according to the displacement method (*California Sta. Rpt. 1923, p. 173, fig. 1*).—Studies by J. C. Martin and J. S. Burd of solutions displaced after the initial displacement solutions had ceased to give uniform concentrations indicated a rise in the concentration of phosphoric acid concurrently with a lowered concentration of other electrolytes. This is taken to indicate the possibility of considerable fluctuation of phosphoric acid concentration in field soils when conditions occur which bring about a lowering of certain other electrolytes. Such a relation must inevitably increase the phosphoric acid concentration of soils which are subject to leaching or in which, for any reason, the cations are removed. The further possibility is suggested that the removal of cations by the plant would tend to increase the phosphoric acid concentration in the soil at the time when the plant can best profit by such enhanced concentration.

Relations of increases in water-extractable soil constituents to their withdrawals by plants and to crop yields (*California Sta. Rpt. 1923, pp. 172, 173*).—Studies of an infertile soil by J. C. Martin and J. S. Burd are said to have shown that there exists a more definite correlation of plant withdrawals with yield of dry matter than with increased solubility of most soil constituents. In the case of nitrate the correlation between increases in water-extractable nitrate is as definite as that between yield and withdrawal. The results are taken to indicate that the amount of growth, however produced, is a preponderating element in causing an increased withdrawal of such constituents from the soil.

Electric charge of clay colloids (*California Sta. Rpt. 1923, p. 171*).—Studies by D. R. Hoagland and W. C. Dayhuff showed that a highly colloidal clay was charged negatively throughout the whole range of H-ion concentrations from pH 2 to pH 12. The intensity of the electric charge was decreased by cations in suitable concentrations, bivalent and trivalent cations being the most effective. No evidence of an isoelectric point was obtained in this clay, and the H-ion concentration of the solution seemed to have a significant effect because of its influence on the quantity of calcium or other multivalent bases held in solution.

[Soil alkali studies at the California Station] (*California Sta. Rpt. 1923, pp. 93, 94*).—Field experiments at Fresno by E. E. Thomas on the use of sulfuric acid, calcium chloride, calcium nitrate, iron sulfate, alum, manure, and

lime for the reclamation of black alkali soil are said to have resulted in a satisfactory yield of barley by the use of calcium nitrate. Promising results also followed the use of calcium chloride and iron sulfate, but there was a complete failure of crop following the use of both lime and manure. The indications are that iron sulfate, if applied in conjunction with a nitrogenous fertilizer, may prove to be a valuable treatment for this soil.

Laboratory studies by A. B. Cummins on the formation of sodium carbonate in soils (E. S. R., 48, p. 515) indicated that, in addition to replacement of bases as a prolific source of black alkali, the reaction of neutral salts with calcium carbonate may also under suitable conditions give substantial amounts of sodium carbonate.

Studies by S. M. Brown on the use of saline irrigation water are said to have shown that the soluble salts applied in irrigation water do not necessarily accumulate in the upper soil zone, but may move downward to a great depth.

[The use of alkali water with least injury to the soil] (*California Sta. Rpt.* 1923, pp. 170, 171).—Preliminary studies by P. L. Hibbard showed that saline water may be passed through certain soils for some time without causing an accumulation of salts in the soil. Sodium carbonate may produce bad effects on the soil very quickly, but this may be largely or entirely prevented if chemically equivalent amounts of gypsum are added to the water before applying it to the soil. The presence of calcium carbonate and organic matter such as alfalfa meal may still further counteract the injurious effects of alkali waters on soil.

Dispersing power of alkali in soil [trans. title], A. DE DOMINICIS (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 17 (1922), [Art. 1], pp. 22).—Studies are reported which showed that electrolytes influence the tendency of soil colloids to change their state. Also progressive dilutions of neutral salts have an influence contrary to dispersion, which is considered to govern the formation of absorptive compounds that are insoluble in the presence of electrolytes.

Constant concentrations of alkali compounds favor dispersion, which is attributed to the influence of the OH ion. This action is caused by the electronegative charge of the soil colloids, particles having the same charge repelling each other.

The OH ions determine both the sign and amount of the charge. Therefore the tendency toward dispersion and major subdivision of the colloids increases with the concentration of active OH ions. The active OH ions which are capable of combining with the colloidal particles are able to influence a certain number of particles of each mass of soil colloids, which coincides with the maximum of dispersion and with the stability of the disperse state. Beyond this maximum the alkalis tend to favor coagulation. This is due to the activity of the ion having an electrical charge opposite to that of the OH ion and the charge of the colloidal particle.

Study of soil acidity and lime deficiency [trans. title], V. VINCENT (*Ann. Sci. Agron. Franç. et Étrangère*, 41 (1924), Nos. 1, pp. 1-13; 2, pp. 122-134).—Studies are reported showing that free lime occurring in the soil in the presence of free silica and alumina is combined according to the formula $\text{SiO}_2 \cdot 3 \text{CaO}$ or $\text{Al}_2\text{O}_3 \cdot 3 \text{CaO}$, with the possible formation of a soluble aluminate $\text{Al}_2\text{O}_3 \cdot 3.5 \text{CaO}$. Where the silica and alumina occur as aluminum silicate, the reactions are the same as where these materials occur alone.

Ferric hydrate does not combine with the lime, but the process is one of lime adsorption, varying in proportion according to the lime-ferric hydrate ratio. Such adsorption is diminished in the presence of free alumina and silica.

Where the lime is combined with carbonic acid the silica is inactive, but the alumina combines according to the formula $Al_2O_3 \cdot 3 CaO$. Calcium bicarbonate, in the presence of free and soluble silica and alumina, precipitates the silica without combining with it, while the alumina remains in solution.

These results are taken to indicate that in the soil lime combines solely with silica and alumina, in addition to organic matter and mineral salts, and is adsorbed in very small quantities by ferric hydrate. In fact, silica and alumina are considered to be of primary importance in the fixation of lime in the soil.

Studies of the influence of solutions of soda, lime, and calcium bicarbonate on ground pebbles showed that coarse pebbles in their natural state in the soil do not possess acid properties, and that free or combined bases react with the silicates.

Studies of the action of lime and the bicarbonates of calcium and sodium on blue clay demonstrated that clay is one of the important factors in the mineral acidity of soils.

Soil washing: The cause and methods of prevention, P. H. STEWART and I. D. WOOD (*Nebr. Agr. Col. Ext. Circ. 123* (1924), pp. 35, figs. 28).—Information on the erosion of Nebraska soils and methods of preventing it are presented in this circular.

Saving soil by use of Mangum terraces, E. W. LEHMANN and F. P. HANSON (*Illinois Sta. Circ. 290* (1924), pp. 19, figs. 18).—Practical information on the planning and construction of Mangum terraces for the prevention of soil erosion in Illinois is presented.

Radioactivity and nitrogen fixers [trans. title], E. KAYSER and H. DELAVAL (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 2, pp. 110-112).—Studies on the influence of a powdered mineral containing 60 per cent of uranium oxide on nitrogen fixation by *Azotobacter chroococcum*, *A. agile*, and *A. de la comore* in a mannite medium showed that this radioactive mineral markedly increased nitrogen fixation in all cases, and that the increase in fixation varied widely for the different organisms. The greatest increase was shown by *A. de la comore*, especially where the radioactive mineral was used in the largest amount employed in the tests.

Nitrogen-fixing bacteria in Vesuvian soils [trans. title], S. RICCARDO (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 18 (1923), [Art. 9], pp. 50, figs. 3).—Studies of the morphology and nitrogen-fixing powers of bacteria in Vesuvian soils are reported, special attention being drawn to the distinction between aerobic and anaerobic types.

The results showed that the group *Bacillus amylobacter* contains anaerobic nitrogen-fixing bacteria which were always present in Vesuvian soils at altitudes under 300 meters (984 ft.). They were not present in these soils at higher altitudes during parts of the year. Species of aerobic Schizomycetes were also present in these soils, which possessed nitrogen-fixing powers in suitable culture media. Other species possessing nitrogen-fixing powers were also present, which are thought to be related to the *Mycoderma*.

The streptothrices in Vesuvian soils [trans. title], S. RICCARDO (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 18 (1923), [Art. 12], pp. 14).—Studies of the life and activities of streptothrices isolated from Vesuvian soils of long cultivation are reported. These organisms were apparently not present in large numbers in these soils, at least in those acted upon by the more recent ashes and during the winter and spring periods. The species isolated seemed to have a certain capacity for nitrogen fixation.

Effect of rice culture on microorganisms of soil (*California Sta. Rpt. 1923*, p. 172).—A comparison of samples of rice soil and fallow soil by P. L.

Hibbard and A. R. Davis is said to have indicated that no marked change in the activities of soil microorganisms has been introduced by the culture of rice.

The yield and mineral content of crop plants as influenced by those preceding, P. S. BURGESS (*Rhode Island Sta. Bul.* 198 (1924), pp. 4-25).—Soil studies are reported which showed that when compared with other crops certain ones, as for example mangels, increased the acidity and readily soluble aluminum content of soils, while others, like redtop, behaved in an opposite manner, and still many others produced no measurable effect. A correlation was found between decreases in the yields of mangels and increases in the acidity and active aluminum content of soils. More aluminum and less phosphorus were present in the mangels from the more acid soils. Mangels were also found to remove large amounts of calcium and magnesium from soils.

The yields of corn were less in all cases when grown following mangels than following corn. This was especially true where either phosphorus, potassium, or lime was omitted in the fertilization. There was a tendency for the corn plants following mangels to absorb larger percentages of acid constituents and of iron and aluminum than for those following corn.

Onions were found to be extremely sensitive to acid soil conditions, and the yields were much impaired by a preceding crop of mangels or by a lack of either lime, phosphorus, or potassium. The percentages of the several ash constituents in onions were higher following mangels than following corn. This was especially true of iron, aluminum, and the acid-forming elements. Carrots showed small differences in yield when following different crops or where lime, phosphorus, or potassium was withheld. The chemical composition of both the tops and the roots was also remarkably constant. Larger yields of oats were invariably obtained following corn than following mangels.

Effects of manure on crop growth (*California Sta. Rpt.* 1923, p. 64).—Studies by J. W. Gilmore and J. A. Denny at the Kearney Substation on soil which has received considerable manure and is becoming unproductive are said to have indicated that the unproductive conditions may be due to an excessive accumulation of nitrate in the soil.

Manures and fertilizers for truck crops, J. H. GOURLEY and R. MAGRUDER (*Ohio Sta. Bul.* 377 (1924), pp. 119-152, figs. 4).—The results of two series of experiments dealing with the fertilization, manuring, and liming of truck crops over a period of eight years are summarized. The crops involved in the 4-year rotation used were sweet corn, cucumbers, cabbage, and tomatoes.

It was found that all four crops often responded differently to a given treatment, and that fertilizers, manures, and lime should be applied in accordance with the requirements of the crop rather than as a basic treatment for all vegetable crops. Ground limestone alone was profitable on all crops, and on cabbage returned a profit of over 1,200 per cent on the investment. When used in connection with 16 tons of manure per acre, ground limestone was profitable on all crops except sweet corn and was especially profitable on cucumbers. It is recommended that ground limestone be applied to soil on which cabbage and sweet corn are to be grown several months previous to the application of acid phosphate in chemical fertilizers.

In the first series a basic treatment of 2 tons of ground limestone biennially and a cover crop of cowpeas and rye was given all plats. The results showed that the production from this soil can be maintained by the use of chemical fertilizers, ground limestone, and cover crops. More than twice as much nitrogen and potash and about half as much phosphoric acid were supplied in the manure as in the largest chemical treatment, and yet the yield was nearly equal in many cases. Furthermore, the net returns from the use of chemical

fertilizers were nearly double in this series, due to the cost of the manurial treatments.

In the second series a cover crop of cowpeas and rye constituted the basic treatment. In this series the use of fresh straw mulch was decidedly unprofitable, and the largest yields were obtained from the treatments of manure or manure with chemical fertilizers, although these treatments were not the most profitable in all cases.

Commercial fertilizers (*California Sta. Rpt. 1923*, pp. 348-360, figs. 3).—The results of cooperative tests with commercial fertilizer materials in 39 counties in California involving the use of 5,507.75 tons of fertilizers are summarized.

Marl digging demonstrations, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 16-19, figs. 4).—Brief information on methods of digging marl with low-cost equipment is presented.

Rotation of chemical elements in agriculture: Sulfur, W. GILTNER and R. M. SNYDER (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 30, 31, fig. 1).—The sulfur cycle in soils, plants, and animals is briefly outlined and illustrated.

Composition and prices of commercial fertilizers in New York in 1923, L. L. VAN SLYKE (*New York State Sta. Bul. 511* (1924), pp. 3-16).—A general review of the situation with regard to commercial fertilizers in New York during 1923 is presented in this bulletin. A comparison is made with pre-war conditions and with changes noted during the years since the war. It is stated that the gradual return to pre-war conditions noted during the past three or four years with respect to the kinds of materials offered for sale, the composition of fertilizer mixtures, and the cost of plant nutrients continued in general through 1923 to an appreciable degree.

Analyses of commercial fertilizers, season 1923-1924, R. N. BRACKETT and H. M. STACKHOUSE (*South Carolina Sta. Bul. 220* (1924), pp. 61).—Guaranties, actual analyses, and relative commercial values of 1,272 samples of fertilizers and fertilizer materials collected for inspection in South Carolina during the season 1923-24 are presented and discussed.

AGRICULTURAL BOTANY

[Studies in] plant nutrition (*California Sta. Rpt. 1923*, pp. 167, 168, 171, 172, 177, 178, figs. 2).—In a study of the composition of plant roots in relation to alkali injury, M. S. Benjamin made an analysis of roots of barley, wheat, pea, and cucumber seedlings grown in tap water or culture solution. Pentoses and starch were found to be absent from all of the roots examined, while the hemicelluloses of the barley and wheat roots consisted chiefly of pentosans with a small amount of hexosans. Much larger amounts of both cellulose and hemicelluloses were found in the barley and wheat than in the pea and cucumber, and this, together with the higher pentosan content, is thought to partly explain the superior resistance of the cereals to alkali injury.

Extending the above work, W. H. Dore analyzed barley and Bermuda grass roots and found no significant differences between the amounts of cellulose, hemicelluloses, and pentosans of these two plants. The higher content of suberin in Bermuda grass roots is thought to possibly account for the remarkable resistance of these plants to alkaline salts.

In continuation of investigations on the influence of the climatic complex upon the duplication of experiments (E. S. R., 48, p. 522), A. R. Davis concludes that the growth efficiency relationship between any two culture solutions may be greatly modified by the various factors making up the climatic

complex, and that such modification may be great enough to prevent the duplication of results.

W. F. Gericke has continued his studies on the growth of wheat in combination with single salt solutions and found that wheat would grow to maturity when the essential elements were supplied in the form of single salt solutions used in rotation, provided the proper salts are used and the proper apportionment of exposure of the cultures to the various salt solutions is made. The order of exposure of the cultures to different single salt solutions is believed to have considerable physiological importance, and it is thought that the physiological response of the plant to a given salt will be affected by the nature of the salt used in a previous exposure. With initial exposure to potassium salts, the highest yield of all types was obtained when magnesium followed the potassium salt, and the lowest when calcium followed potassium salts. With initial exposure to calcium salts, the best yields were obtained when potassium salts followed calcium salts, and the lowest when magnesium salts were used following calcium salts. No great relationship was found between growth and the order of exposure in reference to the initial exposure to magnesium salts.

The results obtained from culture solution experiments by Gericke are said to show that the relative earliness or lateness of different varieties of spring wheat is markedly affected by the kind of media in which the plants are rooted. This indicates that environmental factors, such as the nutrition of plants, play a considerable part in influencing the development of certain genetic characters used in agronomic descriptions of wheat.

D. R. Hoagland and D. C. Caudron, from experiments on the influence of plants on the reaction of culture media, found that numerous single salt solutions, especially ammonium salts and sulfates, brought about an increase of the acidity of culture solutions.

In a study of the nitrogen metabolism of plants, the same authors found from experiments with barley and peas that ammonia nitrogen is present only in small concentrations in the juices from stems, leaves, or roots and is relatively constant in amount. The concentration of nitrate is generally higher in the roots and stems than in the leaves. Preliminary experiments are said to indicate that the concentration of potassium or calcium present in the juices exercises a significant effect upon the reduction of nitrate and upon the formation of complex nitrogenous compounds. Amino acids are reported to be usually present in considerable concentration, and they may be increased or decreased by various conditions which are subject to control.

In continuation of previous experiments (E. S. R., 48, p. 524), A. R. Davis, in work with barley in which the plants were grown to maturity in Hoagland's solution plus sodium chloride in amounts varying from 500 to 1,000 parts per million, found that where the dry weight of the tops was used as a criterion of growth, stimulation over the control was greatest in cultures grown during the winter months when lower temperatures and light values prevail. The higher temperature and light values during the summer period are believed to accelerate the rate of absorption of the salt, the toxic qualities thus being emphasized.

Hoagland, Davis, and J. C. Martin, studying the fresh water alga (*Nitella clavata*), found that the absorption of various ions was determined by a variety of conditions in the culture medium. Nearly all the inorganic elements found in the cell sap were present in dissociated form. Potassium was not combined organically nor was it precipitated out. It was found that

nitrate penetrated more rapidly from a slightly acid solution than from an alkaline solution, and it is believed that this condition exists in the case of the roots of higher plants.

[Plant nutrition studies at the Citrus Experiment Station] (*California Sta. Rpt. 1923, pp. 104-107, figs. 3*).—Summaries are given of the results of studies by H. S. Reed and A. R. C. Haas on the effect of sodium and calcium salts on the growth and composition of orange trees, the toxic effect of chlorides, and the relations of potassium to orange trees. A great increase in the sodium content of the nutrient solution was reflected in the composition of the tree as a whole, but the increase in the sodium content was not proportional to the increase of that element in the nutrient solution. When potassium was omitted from the culture solution, the trees absorbed slightly larger amounts of sodium but gave no evidence that the increased amount of sodium performed any of the functions of potassium. The addition of appreciable amounts of sodium salts to a culture solution retarded the growth of the trees, manifesting its influence principally upon the growth of the shoots and rootlets.

In studies of the effect of calcium on the growth and composition of the orange trees, it was found that the amounts present in leaves depend somewhat upon their age, the trunk and the roots usually having higher percentages of calcium than shoots or rootlets. The ash of leaves from trees grown in soil was generally richer in calcium than those grown in a complete nutrient solution. The percentage of calcium was found to bear an inverse relation to that of potassium. Trees afforded a supply of calcium salts showed less injury from high concentrations of sodium salts, while lack of calcium resulted in characteristic injuries to the foliage, shoots, and rootlets. The effect of a lack of calcium salts on leaves was quite marked, and the repeated stopping and starting of new growth led to the condition known as multiple buds. In the concentrations employed the growth of roots was influenced more by the amount of calcium in solution than by the character of the anion with which the calcium cation was combined in the salt used.

In a study of the toxic effect of chlorides on orange trees, the same authors found that large amounts of chlorides caused tipburn, abscission of the leaves, and death of young shoots. Sodium chloride was found to restrict the root growth under conditions where osmotic influences were eliminated and cause the death of old leaves if the concentration was much in excess of 1,000 parts per million. Calcium chloride in concentrations up to 3,000 parts per million increased the growth of roots and tops, although slight injury was caused by the higher concentration. It was found that the composition of the ash of trees reflected increased concentrations of chlorides in sand or soil cultures. Chloride contents as high as 20 per cent of the ash were found in leaves severely injured by sodium chloride. Soils which had been irrigated with sodium chloride solution until the trees were severely injured were freed from the harmful amounts of chlorides by leaching with water and subsequent additions of nutrient solution. Saline soil from an orange grove was greatly improved for trees by a process of leaching and treatment with nutrient solution.

The authors found that orange trees in sand cultures to which no potassium salts were added made a fair growth for about a year and a half. There was some tendency for chlorophyll to fade in the leaves, but no premature abscission occurred. The sap of the leaves was slightly more acid than that from trees in other cultures which received potassium salts. Leaves of trees to which no calcium salts were supplied were very rich in potassium, and, conversely, those receiving no potassium salts were high in calcium. Where potassium salts were withheld the roots and rootlets were the last to be depleted of that

particular ion. Leaves from trees receiving no potassium were characterized by bronze-colored stripes on either side of the midrib, and in advanced stages of injury dead spots occurred in the bronze-colored areas. Prior to leaf fall there was sometimes a general destruction of chlorophyll.

Studies of factors which affect the solubility of iron in nutrient solutions showed that ferric tartrate soon becomes converted into insoluble compounds, the conversion being more rapid in solutions of higher pH value. The introduction of carbon dioxide lowered the pH of slightly acid, neutral, or alkaline solutions, but did not increase the solubility of the iron compounds which they contain. The addition of certain organic compounds to an alkaline nutrient solution was found to increase the amount of soluble iron in that solution.

In a study of the effect of hydroxyl-ion concentration on walnut roots, the authors found that much of the injury shown by Persian walnut trees may be due to the effect of the hydroxyl ions on the nutrient media rather than to any direct effect on the plant. Walnut seedlings are said to be very sensitive to the lack of calcium, and the injury to walnut roots from solutions of high hydroxyl-ion concentration is to be ascribed principally to calcium starvation rather than to the effect of high hydroxyl-ion concentration upon the plant.

Some relations between the growth and composition of young orange trees and the concentration of the nutrient solution employed, H. S. REED and A. R. C. HAAS (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 277-284, pl. 1).—The authors describe the effects of different concentrations of the nutrient solution upon the growth and composition of young Valencia orange trees (*Citrus sinensis*) and seedlings of the African sour orange (*C. aurantium*).

Sap was expressed from leaves of orange trees and was found to show remarkable constancy in the concentration of solutes and in H-ion concentration, although grown in nutrient solutions of differing composition. Orange seedlings grown in water cultures, in which the concentration was varied from 364 to 3,635 parts per million of solutes, indicated that the most favorable concentration was near 2,200 parts per million. This was also the concentration at which the ratio of transpiration to dry weight was lowest.

The water-soluble inorganic constituents of the dry matter were usually found to be greater in the case of trees which received the more concentrated nutrient solutions, exceptions being found in the case of calcium. The solubility of the inorganic constituents of the dry matter varied considerably in various parts of the tree, the highest percentage being found in the dry matter of the leaves and the next highest, with the exception of phosphates, in the rootlets. The lowest percentage of soluble materials was usually found to occur in the trunk and root.

Transport of organic substances in plants, H. H. DIXON and N. G. BALL (*Nature [London]*, 109 (1922), No. 2730, pp. 236, 237).—Contrary to the statement that the organic materials (carbohydrates, etc.) manufactured in the leaves of plants are transported downward by means of the bast through their organs to places of consumption and storage, which belief seems to the authors to be based entirely on ringing experiments, the bast appears to them to be very unsuitable for carrying out this function. Reasons for this view are given.

The translocation of carbohydrates in the sugar maple, J. ADAMS (*Nature [London]*, 112 (1923), No. 2806, p. 207).—Commenting upon the views of Dixon (E. S. R., 48, p. 430) and of Dixon and Ball as above noted, the author calls attention to the behavior of the sugar maple, as reported by Jones, Edson, and Morse (E. S. R., 15, p. 853). He also cites observations made during the spring of 1923 in the botanical garden at Ottawa indicating that, while

some points in the metabolism of the maple sap may still be obscure, it is evident that the vessels of the wood are able to carry the sugar solution in both directions in the tree trunk, and that the rate of flow is comparatively rapid.

Carbon dioxide production of plant roots as a factor in the feeding power of plants, F. W. PARKER (*Soil Sci.*, 17 (1924), No. 3, pp. 229-247, figs. 2).—Four experiments are reported as to the relation between the carbon dioxide production of plant roots and the feeding capability of the plant.

Cowpeas excreted more carbon dioxide from the roots than did any of the other plants, including soy beans, velvet beans, sorghum, buckwheat, and cotton. Buckwheat roots gave off very little carbon dioxide. Between these lie the other plants, which are very similar in carbon dioxide production. Buckwheat has the greatest feeding power of all here used, while cotton ranks second and sorghum lowest.

No relation was found between carbon dioxide production and the feeding power of plants for calcium, magnesium, phosphorus, or potassium in a rather poor sandy soil. The removal of carbon dioxide by continuous rapid aspiration did not influence the composition of the plants. Different plants absorbed widely different amounts of calcium, magnesium, and phosphorus per gram of carbon dioxide excreted from the roots. For each gram of carbon dioxide so excreted, buckwheat absorbed 41.5 mg. of calcium; sorghum, cowpeas, and soy beans absorbed 5, 12.7, and 21.2 mg., respectively. Cowpeas, velvet beans, and sorghum grown in sand cultures absorbed different amounts of calcium, magnesium, and nitrogen. The legumes contained much higher percentages of these elements than did the sorghum.

"Auximones" and the growth of the green plant, N. A. CLARK and E. M. ROLLER (*Soil Sci.*, 17 (1924), No. 3, pp. 193-198, figs. 5).—The data here presented have been essentially noted from another source (E. S. R., 51, p. 609).

The presence of urease in the nodules on the roots of leguminous plants, E. A. WERNER (*Nature [London]*, 112 (1923), No. 2806, p. 202).—Experiments carried on by the present author and J. V. Collins in Trinity College, Dublin, have proved the presence of urease in various leguminous plants, extending the work of Takeuchi (E. S. R., 22, p. 133) by reporting briefly the presence regularly of urease in the root nodules of all legumes examined, including *Trifolium procumbens*, *T. pratense*, *T. repens*, *Vicia sativa*, *Medicago sativa*, *Galega officinalis*, various lupines, and the garden pea.

From these observations it is concluded that the nodules on the roots of leguminous plants possess an additional function to the one which they have been known to perform since Hellriegel's discovery. While urease was not found in any roots devoid of nodules, clear evidence was obtained of its presence in the cylindrical tuberous growths developed from the rootstock of *Ranunculus ficaria*. This is the only case so far in which the enzyme has been detected in the adjunct of a root outside the leguminous plants.

A comparative study of sand and solution cultures of Marquis wheat, A. L. BAKKE and L. W. ERDMAN (*Amer. Jour. Bot.*, 10 (1923), No. 1, pp. 18-31, fig. 1).—The present study, in which a comparison is made of the growth of Marquis wheat in sand and solution cultures, represents one of several experiments involving solution III of the National Research Council series which are now in progress in the plant physiology laboratory at Iowa State College. The object was to determine the best proportion of the three salts KNO_3 , $\text{Ca}(\text{H}_2\text{PO}_4)_2$, and MgSO_4 for the growth of wheat, and also to compare the sand and water culture methods with respect to transpiration, total weight of tops and roots, and the reaction of the media as determined by means of the hydrogen electrode. The plan of the experiment was in all essential details the same as that

recommended by the special committee of the National Research Council on salt requirements of agricultural plants.

"The solutions producing the maximum yield of tops for the sand and water cultures showed marked variations in salt proportions. The 'best' water-culture solution (R2S1) was characterized by having two-eighths of its total osmotic concentration derived from KNO_3 , one-eighth from $\text{Ca}(\text{H}_2\text{PO}_4)_2$, and five-eighths from MgSO_4 . The 'best' sand-culture solution (R3S3) had three-eighths of its total osmotic concentration due to KNO_3 , three-eighths to $\text{Ca}(\text{H}_2\text{PO}_4)_2$, and two-eighths to MgSO_4 . The high-yielding water culture R2S1 was far superior to that in Shive's R5C2 solution. The high-yielding sand culture also gave much greater production than the control solution.

"The largest amount of absorption and the maximum green and dry weight of tops favored the water cultures. The greatest root development was obtained from the sand cultures. In general those cultures having the greatest transpiration for the entire growth period also showed the greatest dry weight of tops and of roots.

"The reaction of the medium in which the plants were grown changed from an average acidity of pH 3.75 before growing the wheat cultures to an average acidity of pH 5.94 for the water cultures and to pH 6.66 for the sand cultures after growing the plants for one $3\frac{1}{2}$ -day period. No correlation could be shown between the total yield of cultures and their corresponding H-ion concentration values."

A gradient of permeability to iodine in wheat seed coats, H. BRAUN (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 225, 226).—A preliminary account is given of experiments carried on by the author to determine the relation of semipermeable seed coats to the entrance of toxic solutes. There was found to be very little spread of iodine under the seed coats from the embryo end either laterally or in a distal direction, and this was true for all other parts of the seed. The entrance of iodine was found to take place over the entire surface of the grain radially but not uniformly. The apparent lateral and distal spread from the embryo end is considered to be due to the existence of a gradient of permeability to iodine in the seed coats, which permeability is greatest near the embryo end, diminishes to a minimum near the distal end, and again increases slightly.

GENETICS

Electrical mutations in botanical species and inheritance in hybridization, A. PIRÒVANO (*La Mutazione Elettrica delle Specie Botaniche e la Disciplina dell' Eredità nell' Ibridazione. Milan: Ulrico Hoepli, 1922, pp. IX+268, pis. 38, figs. 26*).—Ionolization is the general name given to the procedures and processes claimed to result in modification, by such means as electromagnetism, ultraviolet exposure, X-ray, and radioactive emanations, in certain plants subjected thereto, such as *Cucurbita pepo* and *Althea rosea*. These mutations are claimed to be transmitted hereditarily.

Electrogenetics [trans. title], A. RAGIONIERI and A. MEUNISSIER (*Rev. Hort. [Paris]*, 95 (1923), No. 16, p. 334).—These two authors offer comment separately regarding the contribution by Piròvano above noted.

The part played by heredity in plants: Electrogenetics [trans. title], A. PIRÒVANO (*Rev. Hort. [Paris]*, 95 (1923), No. 21, pp. 459-463, figs. 9).—Further discussion is offered regarding the publication above noted and comments thereon.

Genetics (*California Sta. Rpt. 1923, pp. 145-147, fig. 1*).—Genetic studies of *Crepis* have been continued by E. B. Babcock and others. Approximately one-

third of the known species of this genus are now being grown for genetic, cytological, and taxonomic studies. Additional data are presented on inheritance studies of *C. capillaris*. J. L. Collins is reported to have made four additional species crosses, which are being grown for further study.

Heterosis and dominance of size factors in Raphanus, H. B. FROST (*Genetics*, 8 (1923), No. 2, pp. 116-153, figs. 10).—"In 1914 a study of heredity in *Raphanus* was started, employing both ordinary cultivated varieties of radish and wild forms often showing characters of *R. raphanistrum*. The inheritance of color characters has been mainly considered, but certain results bearing on the problem of 'hybrid vigor,' obtained somewhat incidentally, seem to deserve special presentation. The present paper, therefore, gives numerical data and general observations relating to the relative vigor of selfed lines and crosses; observations on self-sterility and natural crossing; and evidence indicating the presence of biologically unfavorable recessive genes in the material. Evidence bearing on the behavior of several identified genes, two of them showing linkage, is given largely because of its intrinsic genetic interest, but it is included in this paper because of its bearing on heterosis. . . .

"Certain *Raphanus* races, both wild and cultivated, proved to be highly heterozygous. Much self-sterility was evidently presented, especially in wild races showing characters of *R. raphanistrum*. Selfing for two generations isolated markedly different lines, homozygous for certain genes. The selfed lines were often markedly deficient in vigor. Crosses between such lines were very vigorous; they very commonly exceeded the larger selfed race in the size characters studied, and usually at least approached the earlier race in time of flowering. In the F_2 generation, extensive segregation and recombination occurred, with increase of variability and evidently decrease of average size. One case of linkage, involving color and size genes, was found. Certain results obtained tend to support the 'dominant-factor' interpretation of heterosis."

Inheritance in barley.—I, The lateral florets and the rachilla, F. L. ENGLEADOW (*Jour. Genetics*, 10 (1920), No. 2, pp. 93+108, figs. 3).—Genetic study of hybrids between varieties of barley indicated that one factor governs the type of hairs on the rachilla, bristly being dominant to smooth. It was thought possible that the same factor also governs the type of hair in the glume, rachis segment, and lodicule. The several forms of lateral floret in *Hordeum sativum* here described appeared to have simple Mendelian modes of inheritance, and seemed to afford an example of multiple allelomorphism. Comment is made upon the views presented by Blaringhem (*E. S. R.*, 43, p. 632) concerning the results of certain crosses between 6-row and 2-row barleys.

Inheritance in barley.—II, The awn and the lateral floret, F. L. ENGLEADOW (*Jour. Agr. Sci. [England]*, 11 (1921), No. 2, pp. 159-196, pl. 1, figs. 5).—Results derived from a series of crosses of various awned barleys with *Hordeum distichum inerme* are described. The experimental evidence led to the general conclusion that the presence of a full-length awn is due to the homozygous presence in the plant of one factor, while the intermediate or half-awn corresponds to the heterozygous presence of the factor and the absence of the awn to the absence of the factor. Although unifactorial inheritance seemed quite probable, further investigation upon awn inheritance involving studies of physiological anatomy is suggested.

Observation on the hybrid progeny of the crosses of *H. hexastichum*, *H. intermedium*, *H. distichum*, and *H. decipiens* with *inerme* showed that "fertility" of the lateral floret segregates on a 1 : 2 : 1 basis. In *H. hexastichum* crosses it is inseparable from "full awn" whereas in *H. intermedium* crosses

this is not the case. Relatively long glumes are inseparable from awnlessness and conversely, while, finally, dense-rachis is similarly inseparable from a large outer palea (lateral floret). Fluctuation of the awn and the lateral floret was very pronounced in some cases. It seemed possible that in consequence multifactorial inheritance might be suspected where actually only one factor was concerned. Thus in one cross the F_2 evidence warranted the postulation of three factors, one an inhibitor, whereas from the F_1 unifactorial inheritance was established.

Inheritance in barley.—III, The awn and lateral floret (contd.): **Fluctuation, a linkage, multiple allelomorphs**, F. L. ENGLEADOW (*Jour. Genetics*, 14 (1924), No. 1, pp. 49–87, figs. 8).—Continued investigations along the above lines involved further study of the fluctuation of the barley awn and lateral floret; observations on the fluctuation of spike-width; and descriptions of an awn-lateral floret linkage and of a case of vicinism in barley. The genetic relationships of the awn and the lateral floret in the main groups of *Hordeum sativum* and multiple allelomorphism in *H. sativum* are discussed in some detail. The multiple allelomorphism believed at first to be a simple phenomenon appears from later evidence to be complex.

Methods of corn breeding, H. K. HAYES and L. ALEXANDER (*Minnesota Sta. Bul.* 210 (1924), pp. 22, figs. 6).—The comparative value of different methods of seed selection as applied to an adapted variety of corn, Rustler White Dent, and the merits of F_1 hybrids between standard varieties are set forth, together with a brief review of corn improvement studies and suggestions for the farmer who produces his own seed.

The use of F_1 seed obtained by crossing the remnants of higher yielding ears of the ear-to-row tests gave slightly better yields than selection in perfect stand hills and from vigorous stalks. However, the yields obtained from seed selected from an increase plat planted with such F_1 seed were slightly lower than those from selection in perfect stand hills. Selection for score-card type of ear resulted in a slightly reduced yield, even though the plants were first selected on a yield basis from perfect stand hills. As regards yielding ability, seed selected at husking did not differ essentially from seed chosen from vigorous stalks in perfect stand hills, nor did seed selected during seed corn week differ notably, whether stored immediately or cured in the shock before storing. The ear-to-row plan seems to be of slight value from the farmer's standpoint, and its continuous use appears undesirable under any circumstances. An adapted variety of corn can apparently be kept in a constant state of improvement by selection on the basis of vigor without close selection for score-card ear type.

The only type of F_1 varietal cross proving of much value was the hybrid between an early flint and a later dent (E. S. R., 45, p. 633), which appeared of promise for northern Minnesota. If selection to ear type is not closely followed, it is concluded that the use of F_1 crosses between standard varieties will not lead to a material increase in yield.

A primitive sporophyte in maize, W. H. EYSTER (*Amer. Jour. Bot.*, 11 (1924), No. 1, pp. 7–14, figs. 3).—Embryos of corn normally become dormant in the seed stage, remaining so until favorable growth conditions are provided. Kernels with embryos which did not become dormant in the seed stage, but continued to grow as long as enough moisture was available, were found scattered over the surface of ears of corn grown in the summer of 1921 at the Missouri Experiment Station. This characteristic of growth was termed "primitive sporophyte" because of its resemblance to the sporophytes of more primitive plants. Primitive sporophyte was found to be inherited as a

simple Mendelian recessive. Its factor appeared to be closely linked with factors for pale yellow endosperm and albino seedling.

A second factor for primitive sporophyte in maize, W. H. EYSTER (*Amer. Nat.*, 58 (1924), No. 658, pp. 436-439).—The present paper is concerned with continuously growing sporophytes occurring in a strain of maize quite distinct from that in which were found the sprouted kernels described above. Inter-crosses showed that the sprouted kernels in the two strains are due to distinct factors called primitive₁ and primitive₂, respectively, with the factorial symbols pm_1 and pm_2 .

A hybrid between different species of cotton, T. H. KEARNEY (*Jour. Heredity*, 15 (1924), No. 7, pp. 309-320, figs. 11).—The more important aspects of hybrids between Egyptian and upland cotton (E. S. R., 50, p. 24) are reviewed, with emphasis on the profound modification of the whole organism resulting from so wide a cross.

Inheritance of the colour pattern of King Edward potato, E. J. COLLINS (*Jour. Genetics*, 14 (1924), No. 2, pp. 201, 202).—The progenies of the King Edward potato (splashed with pink in and around the eyes) crossed with Majestic (regarded as a homozygous recessive white) gave results suggesting that the parti-colored pattern typical of King Edward depends on a definite factor, existing in the variety in a heterozygous condition. If obtainable in a homozygous state it should breed true, behave as a dominant to the recessive white, and be recessive to full color.

Seed progeny of a potato with faintly coloured tubers, J. P. KELLY (*Jour. Genetics*, 14 (1924), No. 2, pp. 197-199).—The inheritance of tuber color in the seed progeny of self-pollinated Red McCormick potatoes and of hybrids between Red McCormick and cream tuber varieties of the Rural group of potatoes is discussed briefly.

Inbreeding grain sorghum, A. B. CONNER and R. E. KAPER (*Jour. Heredity*, 15 (1924), No. 7, pp. 299-302, figs. 2).—Inheritance studies with strains of Blackhull kafir (E. S. R., 45, p. 535) isolated at the Lubbock, Texas, Substation, by inbreeding for single characters for six and seven generations gave evidence that inbreeding in kafir fixes individuality by the isolation of homozygous forms. The results of inbreeding may be good or bad, depending upon the hereditary characteristics of homozygous forms. Inbreeding has not caused a reduction or increase in the size of the head or in productivity, except in so far as it has isolated subvarieties differing from the parent family.

FIELD CROPS

[Field crops experiments in California] (*California Sta. Rpt.* 1923, pp. 57-63, 64, 65-68, 70-74, 151-153, figs. 12).—In further trials (E. S. R., 48, p. 526), G. W. Hendry found White Yolo to yield more grain and less stover than Dwarf milo when grown without irrigation at Davis. Examination of the soil to a depth of 4 ft. following harvest revealed to Hendry and J. P. Conrad a higher residual moisture content upon plats which had produced White Yolo than on those which had produced Dwarf milo. J. W. Gilmore found the total height range of unirrigated White Yolo to be 23 in. and of Dwarf milo 54 in., with 90.3 and 70.5 per cent, respectively, of the heads standing between 40 and 50 in. above ground. In comparative trials on farms milo yielded highest on moist soils and under irrigation, while Yolo excelled upon upland soils without irrigation. The Dwarf milos and feterita were the best grain producers in experiments in Imperial Valley conducted by W. W. Mackie and L. G. Goar, but the leading Dwarf milos lodged very badly. White Yolo stood erect but was inferior to the Dwarf milos in yield. The most productive spacing for Dwarf

milo on the hard soils of Imperial Valley appeared to provide for plants 6 in. apart in 4.5-ft. rows, and July 15 was the most favorable date of seeding.

Onas with 81.9 bu., Little Club with 78.2, Oudebaard with 71.5, Defiance with 70.9, and Early Baart with 70.6 bu. gave the maximum acre yields in replicated plat tests with wheat varieties by Gilmore, V. H. Florell, and Hendry, and Federation led the nursery-grown Australian wheat varieties. In milling and baking tests with the plat-grown wheat varieties in the experimental mill of the Bureau of Agricultural Economics, U. S. D. A., Onas, Marquis, and Bobs showed the highest loaf volume, and Sunset, Quality, and Bobs had the highest protein content. Bobs, Quality, Kharkof, and Marquis produced the most flour. All varieties were of comparatively good quality except Sonora, which had a low color score on account of smut.

Trebi, Arequipa, and Club Mariout were the highest yielding barley varieties in plat tests, and California Mariout, Peru, and Trebi led the barleys compared in nursery rows. Guysa, the best oats variety, produced 113 bu. per acre. Of several oats varieties highly resistant to stem rust Mackie reports that only two strains of Richland offer promise for California conditions. The high yields of soft corn varieties in tests by J. F. Duggar and Florell suggest the desirability of improving varieties of this type.

The culture of tobacco for nicotine extraction by Hendry, breeding work with Yolo and wheat by Gilmore, Florell, and Hendry, and variety tests with cotton are noted, in addition to brief accounts of the behavior and adaptation of Mariout, Club Mariout, Tennessee Winter, and Four Thousand barleys, Burt oats, and Federation, Bunyip, and Onas wheats.

The merits of promising legumes and grasses studied by P. B. Kennedy are described briefly. Cowpeas produced the most green material and the most seed when planted May 2 and May 15, respectively, and in rows 24 or 30 in. apart in tests by Kennedy, B. A. Madson, and J. A. Denny at Kearney Park. Mungo beans made the most green material in the closer spacing and the most seed in 36-in. rows. Experiments by Kennedy, Mackie, and Goar showed berseem clover to have a wide adaptation and to be tolerant to frosts, alkali, and to a comparatively high water table. Trials at Meloland by Mackie and Goar suggest seeding about 15 lbs. per acre around September 1 and irrigating not oftener than once per month. Kennedy and L. Mah have identified six species of *Echinochloa* occurring in California. The following species and varieties of wild oats have been identified by Kennedy and Florell: Slender wild oats (*Avena barbata*), common wild oats (*A. fatua*), smooth common wild oats (*A. fatua glabrata*), animated wild oats (*A. sterilis*), and large-seeded animated wild oats (*A. sterilis macrocarpa*). *A. barbata* and *A. fatua* are the most and about equally abundant in the State, slender wild oats extending into less fertile soils than the common wild oats. Both species are to be regarded as valuable range crops.

Alfalfa yields increased slightly with each 6 in. of water applied at Delhi by M. R. Huberty and F. Davis, the largest yield being made with 42 in. Thirty-six in. of water applied in 6-in. depths produced more alfalfa hay than when applied in 3-, 4-, and 12-in. depths. In tests at Davis conducted by S. H. Beckett, H. A. Wadsworth, and Davis during 1922 the largest acre yields and the most favorable irrigation treatments were as follows: Sudan grass, 8.07 tons with 4 irrigations aggregating 13.53 in. in depth; Dwarf milo, 2.87 tons of grain with 4 irrigations aggregating 13.55 in.; cowpeas, 1,115 lbs. of peas with 3 irrigations aggregating 16.63 in.; corn, 8.85 tons of silage with 3 irrigations aggregating 11.31 in.; and Honey sorgo, 28.17 tons of silage with 4 irrigations aggregating 17.14 in. Hemp responded very definitely to thorough irrigation.

[Field crops work in Uganda in 1922 and 1923], S. SIMPSON, L. HEWETT, ET AL. (*Uganda Dept. Agr. Ann. Rpts. 1922*, pp. 14, 19-21, 23, 25, 26; 1923, pp. 4-7, 9, 26).—The progress of experiments similar to those noted earlier (E. S. R., 48, p. 630) is reported.

A report by the Imperial Institute on hay of *Hyparrhenia rufa* from Uganda showed this hay to be very similar in composition to hay from the same species in Brazil, but that it contains less protein and more crude fiber than young elephant grass. Hay from *H. rufa* contained no alkaloids or cyanogenetic glucosides. *H. rufa*, one of the principal fodder plants in central Brazil, is highly esteemed for fattening and as a maintenance ration, although not favorable to milk production. Cutting the plant for hay at a height of 2 to 3 ft. is indicated for best results.

Emmer and spelt, J. H. MARTIN and C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul. 1429 (1924)*, pp. II+13, figs. 7).—The history, distribution, adaptation, varieties, and uses of emmer and spelt are discussed briefly, and cultural, harvesting, and threshing practices are outlined. Experiments with these crops and einkorn have been detailed elsewhere (E. S. R., 51, p. 435).

The influence of sulfur as a fertilizer on barley [trans. title], W. WINDISCH (*Wchnschr. Brau.*, 41 (1924), No. 15, pp. 71, 72).—Application of flowers of sulfur to barley resulted in a grain with a considerably increased protein content, increases of from 1.33 to 4.3 per cent being observed. The barley produced on soil treated with sulfur was said to have been quite immune to the attacks of grain weevil.

The germination of cottonseed, E. H. TOOLE and P. L. DRUMMOND (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 285-292, pls. 2).—Investigation of the very variable and often unaccountably low results obtained in germination tests of cottonseed, especially seed from Texas, revealed the existence in cottonseed of strong samples with a large percentage of the seeds germinating well under a wide range of conditions; samples containing many dead or weak seeds which always fail to produce healthy seedlings; and "sensitive" samples, in which a large percentage of the seeds are viable and can produce seedlings, although the seeds tend to die under unfavorable germination conditions. The mold and decay seen when sensitive samples are germinated by the standard method were not due to contamination of the substratum or of the germinator, nor did the excessive molding depend on the temperature of germination. Sensitive samples did not appear to be the result of heating in storage.

It was found that the live seed in the sensitive samples could be determined by testing the seeds in soil with controlled moisture content and temperatures; often by soil tests in the greenhouse; by tests in sphagnum moss; to some extent by presoaking the seeds; by surface sterilizing the seeds; and by simply wetting the fuzz of the seeds before putting them to germinate. Field studies with samples of Lone Star and Mebane seed showed that on the whole, the sensitive samples were not so poor as would be indicated by the standard test, being capable of producing a good stand of plants with favorable field conditions. On the other hand, they were not so valuable as the strong samples, as would be indicated by the prewetting method test, being decidedly less able to withstand extremes of temperature or of moisture.

Although retaining its vitality longer during storage, very dry cottonseed will not germinate as promptly or vigorously when planted as seed with higher moisture content (about 12 per cent). If cottonseed is excessively dry at planting time, it is suggested that germination can be advanced by artificially raising the moisture content of the seed by prewetting or presoaking before planting in the field.

The salt content of cotton fiber, T. H. KEARNEY and C. S. SCOFIELD (*Jour. Agr. Research* [U. S.], 28 (1924), No. 3, pp. 293-295).—Determinations of the water-soluble salts and ash in samples of cotton fiber indicated that, as grown on similar soil in Arizona, the salt content of the fiber of Pima cotton is not appreciably higher than that of Sea Island and upland cottons. Nor do Sea Island and upland cottons grown on irrigated land in Arizona contain appreciably more salt than lint of the same varieties grown in South Carolina. Somewhat more salt was observed in fiber of Pima cotton from a very salty field than in Pima fiber from good soil. Pima fiber that had been exposed to dust did not have a higher salt content than Pima fiber from unopened bolls. On the average, 85 per cent of the total salts and ash in cotton fiber appear to be water-soluble material, while 67 per cent is nonvolatile material.

The hygroscopicity of the salts present in unwashed Pima fiber seemed to be practically negligible, and the fiber produced by plants growing in saline soil had no higher capacity for hygroscopic absorption of moisture than the fiber produced by plants growing in nonsaline soil. The difficulties said to be encountered in spinning Pima cotton under certain conditions of the atmosphere are not held attributable to the salt content of the fiber.

Markton, an oat variety immune from covered smut, T. R. STANTON, D. E. STEPHENS, and E. F. GAINES (*U. S. Dept. Agr., Dept. Circ. 324* (1924), pp. 8, fig. 1).—Markton oats, recently found to be immune from covered smut at Pullman, Wash., by the Washington Experiment Station, was selected from an unnamed variety of oats, C. I. No. 357, at the Sherman County Branch Station, Moro, Oreg., in 1911. The original unnamed oats was obtained at the Louisiana Purchase Exposition in 1904 from a sample said to have come from Dede Agatch, Turkey.

Markton, which seems to be the first variety of common oats with yellowish white kernels and high yielding power and immune from covered smut, has been the highest yielding variety at Moro, Oreg., and at Pullman and Waterville, Wash., during the periods in which it has been compared. Excellent yields have been obtained from Markton at Moccasin, Mont., and from the original variety, C. I. No. 357, at Newell, S. Dak. If Markton does not prove superior for commercial purposes, the authors think that it should still be valuable for use in crossing to produce other smut-immune varieties.

Potato investigations at the North Central Experiment Station, 1914-1923, O. I. BERGH (*Minnesota Sta. Bul. 212* (1924), pp. 5-58, figs. 29).—Experiments with potatoes during the period indicated were concerned with varieties, improvement work, fertilizer treatment, cultural methods, and field practices. The progress of these studies has been noted (*E. S. R.*, 50, p. 133).

Green Mountain, Irish Cobbler, Bliss Triumph, Burbank Russet, and Rural Russet were outstanding among the varieties. Immature seed gave as good results as mature seed, and seed grown on peat land equaled that grown on mineral soil. The yield varied directly with the size of the sets, and whole tubers outyielded either halves or quarters. The results suggest planting relatively large pieces when seed is low in price. The fact that plants adjacent to missing hills made up only about 12 per cent of the loss showed the importance of a uniform and full stand.

Continued cropping without renewing soil fertility soon reduced the yield to a point where the crop was grown at a loss. In fertilizer tests, a nitrogen fertilizer applied alone for potatoes was not profitable, and phosphates alone were used at a decided loss. Potassium was profitable in every case, whether applied alone or in combination with nitrogen and phosphoric acid. Mixed fertilizers produced a profitable increase when they contained a liberal amount of

potassium. The increased yield from applications of peat did not cover the cost.

Applications of stable manure were always profitable, the largest increases in the crop from each ton applied accruing from a light acre application. However, the acre yield increased as the quantity of manure applied was increased, but at a lower rate. Where 5, 10, and 20 tons of manure per acre had been applied each third year for nine years, the potato yield for 1923 was increased 18.9 bu., 13.3, and 10.9 bu., respectively, for each ton added. The growing cost was 69 cts. per bu. of marketable tubers when grown unmanured, 30.5 cts. with 5 tons of manure per acre, 27.5 cts. with 10 tons, and 22.5 cts. with 20 tons. Discussion of stable manure and the conservation and use of the plant nutrients therein by proper handling is appended.

Size of potato sets: Comparisons of whole and cut seed, W. STUART, P. M. LOMBARD, M. C. VOSBURY, G. CORDER, W. C. EDMUNDSON, C. F. CLARK, and G. W. DEWEY (*U. S. Dept. Agr. Bul. 1248 (1924), pp. 44, figs. 12*).—A comprehensive review of experiments on the influence of the size of the potato set or seed piece upon the resultant crop, carried on during more than a century, suggested that much of the data presented is inconclusive. Much appeared to depend upon the experimental procedure whether whole or cut sets gave the most profitable yield. The successful determination of the most profitable size of set and whether it should be planted whole or cut seem to involve primarily a careful study of the proper spacing for each size of set in order to obtain the maximum yield.

Departmental studies at the Virginia Truck Experiment Station; Caribou and Presque Isle, Me.; Greeley, Colo. (E. S. R., 45, pp. 39, 634); and Jerome, Idaho, covering several years showed rather conflicting results, so far as the yield of primes, or marketable potatoes, was concerned. Seasonal conditions appeared to have a very definite influence upon yield, particularly with respect to the size of the tubers. Abundance of moisture and plant food throughout the growing season insures a maximum crop from whole and large sized cut sets, whereas lack of these favors medium sized cut sets, because fewer and consequently better tubers are produced.

A definite relation is to be noted between the size of the set used and the number of stems and tubers produced to the set. A study of stem-frequency correlation showed that with whole seed the stem-frequency shifts from three stems in the case of 2-oz. sets to seven stems in the case of 6-oz. sets. Halved seed shifts from two stems to four stems. With quartered sets on the other hand, whether from 3-, 4-, 5-, or 6-oz. tubers, the greatest stem-frequency was in the two-stem group in the Presque Isle data. In the Virginia data whole sets shift from three to five stems, halved sets from two to three stems, and quartered sets from one to two stems.

A list of 105 references to literature cited is appended.

Handling rough rice to produce high grades, W. D. SMITH (*U. S. Dept. Agr., Farmers' Bul. 1420 (1924), pp. II+22, figs. 19*).—The classes and grades of rough rice are defined, with comments on the means of handling the crop to avoid common defects of rough rice. These defects, which include red rice, weed seeds, other grains, small mud lumps, gravel, stones, other foreign material, thresher-broken kernels, damaged kernels, heat damaged grains, a high moisture content, and a low test weight per bushel, may be reduced or eliminated by the use of better seed, by better cultural methods, by harvesting the crop at the proper stage of maturity, by improved methods of shocking and threshing, by cleaning the threshed rice, and by providing suitable storage facilities for the threshed grain.

Sorghum experiments on the Great Plains, H. N. VINALL, R. E. GETTY, and A. B. CRON (*U. S. Dept. Agr. Bul. 1260 (1924), pp. 88, figs. 23*).—Varietal and cultural experiments with sorghum, carried on principally in the southern half of the Great Plains in cooperation with the State experiment stations of the region, are assembled with discussion of the climatic features, soils, and native vegetation of the sorghum belt, and descriptions of experimental methods employed, and of sorghum groups and varieties. See also earlier notes (*E. S. R.*, 45, p. 32; 46, p. 636; 49, p. 827).

Experimental results and the experiences of farmers indicate that the sorghos are superior to the grain sorghums whenever forage alone is desired. Well-adapted varieties of sorgho have excelled the best varieties of grain sorghum in yields of hay, fodder, and silage in every part of the Great Plains and in other sections where sorghums are grown. Sorgho hay and fodder are considered of better quality, or at least more palatable, than the hay and fodder of grain sorghums, and recent feeding tests showed but little difference in the feeding value of the silages. None of the sorghums are reliable grain producers in the northern Great Plains. While corn, millet, and the small grains are preferable to sorghum for forage in North Dakota and Montana, the early sorgho varieties make higher yields of fodder than these crops in South Dakota and yield equally as high in northeastern Wyoming.

The principal factors determining the best date to seed sorghums include soil conditions, the available growing season, varietal characteristics, and the purpose for which the crop is grown. Results of date of seeding experiments from eight substations hardly warrant seeding before the soil is warm, moist, and clean, and danger of soil blowing is past. The available time for seeding extends roughly from the average date of the last killing frost in spring to within 90 or 100 days of the average date of the first killing frost in the fall, allowing a maximum period of 60 days in northern Kansas and about 120 days at the southernmost stations. Irrespective of locality, the maximum forage yields are obtained from varieties best using the entire available growing season. In the South, where Sumac sorgho is grown, the favorable seeding period may be from May 1 to June 15, with somewhat larger forage yields but less grain from seedings between June 1 and 15. The best period for seeding from southern Kansas to central Nebraska is between May 15 and June 1 and north of this region during the first week of June.

Rather extensive rate of seeding experiments at Hays, Kans., and Chillicothe and Amarillo, Tex., indicate that a 4-in. row space is best for forage purposes, and 8- to 12-in. space for grain yields. However, the row space and the space between the rows appear to be factors of less importance than the choice of varieties. Results at Hays and Chillicothe indicate that larger yields may be expected from rows spaced the ordinary distance rather than 80 in. apart. Comparison of field and laboratory germination at Amarillo suggested that, on the average, in field seedings about half the germination obtained in laboratory tests should be expected. A rate of from 30 to 45 lbs. per acre, according to the size and quality of the seed, seems desirable for close-drilled seedings of sorgho in that part of the sorghum belt averaging less than 25 in. rainfall annually. In more humid areas higher rates, usually from 1 to 2 bu. per acre, are preferred.

Close-drilled seedings of Red Amber sorgho were cut at Hays before heading, when partially headed, from bloom to dough, and when seed were ripe. The data showed that the yields ordinarily increase with the length of the growing season. The quality of the hay from the second and third stages appeared best, and all factors considered, cutting at the third stage of maturity or a

little later is probably the most practicable for farm purposes. Analyses of the hay from the different cuttings showed a definite increase in the percentage of nitrogen-free extract as the sorghum approached maturity, and a corresponding though less pronounced decrease in the percentage of all the other principal food elements. In everything except protein and crude fiber the yields were largest from the fourth stage of maturity, and a deficiency in crude fiber is usually considered an advantage.

[Cutting back cane not profitable], J. A. VERRET (*Hawaii. Planters' Rec.*, 28 (1924), No. 2, pp. 264-267; *abs. in Facts About Sugar*, 18 (1924), No. 24, p. 567).—Field tests in Hawaii indicated that the practice of cutting back sugar cane in July which was planted or ratooned in March, April, or May, for the purpose of preventing tasseling later on, not only reduces the production of cane and of sugar but is more costly than not cutting back.

Loss of sugar due to burning cane before cutting, J. P. FRANK (*Assoc. Hawaii. Sugar Technol. Rpts.*, 1 (1922); *abs. in Internatl. Sugar Jour.*, 25 (1923), No. 297, p. 494).—When cane is burned before cutting, a sticky substance is found on the stalks, the amount of which varies with the intensity of the heat, being greatest when the cane is unstripped and the trash dry. This so-called "sweating" was examined at the Onomea Sugar Company of Hawaii and proved to be concentrated juice. If the cane is sent to the mill in flumes, the sweating is entirely dissolved in the water, making another source of loss in addition to the sucrose lost by deterioration between the time of cutting and milling. Sucrose in the sweating per 100 parts of sucrose in the cane amounted in unstripped cane with light fire and wet trash to 0.81, light burning 0.96, wet trash 1.18, normal fire 2.35, and hot fire 6.08 and 7.46; and in stripped cane with light fire 0.79 and hot fire 2.43.

Relation of yield of wheat to length of period of growth (*California Sta. Rpt. 1923*, p. 166).—W. F. Gericke found a correlation to exist between the grain yield and the relative earliness of different varieties of spring wheat when grown in a medium markedly deficient in nutrients. Of ten different varieties ranging from very early to very late, the largest yield was produced by the variety maturing first and the lowest yield by that maturing last, with the intervening values generally corresponding to the relative earliness of the variety. This correlation was not observed when the varieties were grown in media well supplied with nutrients.

[Studies on factors influencing protein content of wheat] (*California Sta. Rpt. 1923*, pp. 166, 167).—Ten different varieties of spring wheat ranging from very early to very late, planted by W. F. Gericke in a soil of a moderate fertility, and treated with sodium nitrate at different stages of growth, were grown to maturity in pots in the greenhouse. Analyses of grain produced indicated that the magnitude of change in the nitrogen and hence in protein content of early wheat, effected by nitrogen supplied at different times in the period of growth, is much smaller than that produced by similar treatments to late maturing varieties. The protein content of the varieties maturing earliest was changed by the treatment from 25 to 50 per cent, and in the very late varieties more than 100 per cent. Wheats which are genetically early seem physiologically better adapted to produce high protein grain, when grown under conditions where the supply of nitrogen available at later stages of growth becomes a limiting factor.

Agricultural seeds from overseas: Effect of the voyage on germination capacity, A. W. S. MOODIE (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 1, pp. 59, 60).—Seed of five grasses and of red clover was stored in a storeroom at a temperature range of 85-121° F., in a tank room at 25-36°, and in a cabin

at 59-92° for 46 days during shipment from England to Sydney, N. S. Wales. Comparative germination tests show seed stored in the tank room to give the most uniform results for all species.

Prolific weeds, W. F. BLAKELY (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 5, pp. 346-348).—Notable recent examples of weeds appearing in abundance in New South Wales include caltrops (*Tribulus terrestris*), wild heliotrope (*Heliotropium europaeum*), California stinkweed (*Gilia squarrosa*), buffalo bur (*Solanum rostratum*), *Centaurea solstitialis*, stinkwort (*Inula graveolens*), and stinking roger (*Tagetes minuta*).

HORTICULTURE

[Horticultural investigations at the California Station] (*California Sta. Rpt.* 1923, pp. 90-93, 94-96, 101-104, 108-110, 148, 149, 155, 156, 188, 189, 190, 191, 196, 197, 199-201, 203, 205, 206, 208-217, 247-250, 250-255, figs. 19).—A progress report (E. S. R., 48, p. 533) upon investigational activities in citriculture, general pomology, viticulture, etc.

As reported by H. J. Webber, the differences between citrus trees grown from large, intermediate, and small-sized nursery stock were less notable than in earlier years, some of the trees in the plat planted with small stock being nearly as large as those in the large stock area. However, the advantage of large-sized nursery trees was shown in a commercial Valencia orchard near Pasadena, where a block of trees grown from selected stock was decidedly superior to others grown from inferior stock. Studies by Webber of rootstock materials led to the conclusion that not all types or varieties of a species make satisfactory stocks, indicating variability within a species and the desirability of selected strains or varieties suitable for seed production which can be depended upon to produce vigorous seedlings congenial to the scion. Work with the Florida Rough lemon indicated that it may prove to be a good stock for the lemon and also for the Washington Navel orange, particularly in the dry interior valleys. In considering possible combination plantings, Webber suggests that in the Imperial and Coachella Valleys it is likely that the date and the grapefruit may be successfully interplanted. It is thought that in the hot, dry interior valleys the orange may be advantageously interplanted with either the apricot, prune, or walnut.

Studies by L. D. Batchelor and J. T. Barrett upon the causes of blackmeated and moldy walnuts are again reviewed (E. S. R., 51, p. 42). As reported by R. S. Vaile and G. J. Surr, alfalfa is not a satisfactory permanent cover crop for Tulare County citrus orchards. Purple vetch proved a good winter cover crop during the season 1922-23. Winter cover crops are deemed desirable on Tulare County adobe soils, which, because of their high moisture-retaining capacities, are often too wet in the early spring to support a satisfactory growth. The results of a citrus orchard survey are again discussed by Vaile (E. S. R., 51, p. 443).

E. T. Bartholomew found that winter-injured citrus trees bore more fruits infected with internal decline than did normal trees, showing a likely association of tree weakness with this trouble. No correlation was found between seed content and internal decline, but it was found that affected lemons, especially yellow fruits, contained conspicuously less juice and acid than did normal fruits. Studies by F. F. Halma upon growth and fruit bud differentiation in the Eureka lemon showed that branches tied in a horizontal position produced over twice as many laterals as did vertical branches. Furthermore, nearly all the laterals produced on the horizontal branches were of the fruiting type. The fact that laterals were produced only from the upper side of

horizontal branches is deemed to support a previously proposed theory (E. S. R., 44, p. 133) of an inhibiting substance controlled by gravity.

Biometrical studies by H. S. Reed upon growth and correlation in apricot branches showed a distinct cyclic growth during the first season, each phase of which may be expressed by a logarithmic equation similar to that of autocatalysis. A high degree of association was recorded between the length but not the number of laterals and the length of the parent branch. The mean number of secondary laterals to the branch showed a close correlation with a mean number of primary laterals. The mean number of blossoms to the lateral was found to be rather constant irrespective of length, indicating that factors of environment are less important than hereditary characters in determining distribution.

Studies by H. B. Frost upon citrus seedlings at Riverside showed a remarkable variability in the F_1 generation in relation to vigor, shape, and pigmentation of leaves. Crosses between mutant and ancestral types of *Matthiola* (stocks) gave rise to both normal and mutant progeny. When selfed, the mutant types yielded both normal and mutant forms, in no case breeding true. Certain mutant forms, contrary to expectation, bore a larger proportion of single flowers than did their parent variety. Cytological studies by Frost and M. C. Mann show that the large-leaved mutant has one unpaired chromosome in addition to the seven pairs ordinarily occurring in pollen mother cells of normal plants. Observation by Frost on F_2 radish hybrids showed them to be inferior in size and vigor to the F_1 generation. It is thought that desirable characters such as red color and enlargement of roots depend upon recessive or imperfectly recessive genes which are maintained against natural selection only by human agency. The Moki Lima bean and the white-seeded cowpeas were able to produce seed when grown under irrigation at Riverside.

Observations upon the rooting capacity in the greenhouse of deciduous fruit cuttings, representing a large number of varieties and forms of fig, pear, plum, apple, and peach, showed only a few with the ability to root readily, while many formed callus tissue. Studies conducted by F. J. Veihmeyer and A. H. Hendrickson with prune trees growing in potometers indicated that the rate of use of soil moisture through transpiration is not materially influenced by the amount of moisture present in the soil, provided that it is not below the wilting point. Attempts to prolong the growing period by supplying abundant moisture at the close of the season failed.

Observations by M. J. Heppner upon almond seedlings resulting from breeding operations conducted in previous years by W. P. Tufts and G. L. Philp showed some late blossoming trees. Of 243 fruiting trees, 59 bore bitter and 184 sweet almonds, approximating the theoretical Mendelian monohybrid ratio 3:1. In an attempt by F. Lohse to establish correlations between bitterness of almonds and external or internal characters in the tree, it was found that twigs of the bitter fruited trees when placed for 24 hours in a solution of ammonium or potassium sulfocyanid gave off the odor of amygdalin, while in the case of sweet almonds no odor was detected but the pith turned brown. It is thought this may furnish a means of culling out bitter almond trees in the nursery row.

Studies by J. L. Fidler of the effect of storage temperature upon the keeping of apples showed that with a very few exceptions 30–32° F. is a most satisfactory range, fruits held at this point keeping on an average one month longer than those at 36°. In addition, the development of scald and blue mold was hindered by the lower temperature. As exceptions, Jonathan kept best at 36° and Yellow Newtown at 40°. At 45° wilt, blue mold, and scald materially injured all apple varieties. Varietal tests showed Winesap, Hoover, Ben

Davis, Gano, White Pearmain, and Stayman to be good keepers, holding in good condition until after May 15. The Yellow Bellflower, usually not considered a storage apple, retained its quality and flavor in a satisfactory manner. In respect to wilting, immature fruits wilted much more readily than did mature. Certain varieties, Jonathan, McIntosh, Wagener, Grimes, etc., were especially susceptible to wilting. Observations upon the keeping quality of Delicious and Gravenstein apples harvested at different intervals indicated that each variety has a particular requirement. For example, Gravenstein kept best when picked firm ripe and Delicious best when harvested slightly green. Early picked Delicious kept in excellent condition at 32° until May 1.

As conducted by R. J. Platt and F. R. Hodgson, storage studies with cherries indicated that varieties with dark flesh and normally having a high sugar content may be kept if picked when well ripened for approximately 6 weeks at 26°, freezing being probably prevented by the large sugar content. At 32° cherries kept 4 weeks, at 36° 3 weeks, and at 45° 2 weeks. Napoleon, Republican, Black Tartarian, and Windsor were found good keeping varieties.

Pear storage investigations conducted by E. C. Overholser and L. P. Latimer showed that immature fruit keeps better at 36° than at lower temperatures. Observations upon Hardy, Bosc, and Comice pears picked at different seasons showed in all cases that fruits picked later than the usual commercial date but before overripe attained larger size, better color, and finer eating qualities than earlier picked fruits. Plum storage studies conducted by E. H. Rawl showed 32° to be most favorable for fruit picked at the proper stage of maturity. A gradual increase in sugar content was noted with the approach of maturity on the tree, suggesting the advisability of leaving plums on the tree until quite ripe.

Studies by Hendrickson showed that on quiet nights the temperature of the air at 15 ft. elevation in the orchard is usually 2-4° warmer than at 5 ft. When orchard heaters were in action, there was nearly as great a rise in temperature at 15 as at 5 ft., showing that the tops of large fruit trees are benefited by heating.

Observations by C. B. Wiggans on the development of pear and apricot buds in different localities showed that, with the exception of altitude, the initiation of differentiation was unaffected by environment, occurring at about the same date under coastal, interior valley, or foothill conditions. Environment did, on the other hand, affect the rate and completion of development. The amount of pruning apparently had no influence on the inception of differentiation, while irrigation tended to retard development. Winter conditions apparently did not check fruit bud development in the pear and apricot.

In potometer studies with prunes at Mountain View, Veihmeyer and Hendrickson found that the ratio of water loss to leaf area and to new length growth were remarkably uniform. The coefficients of correlation for water loss to leaf area and to new length growth nearly approached unity, with only small probable error.

As reported by F. W. Allen, closely planted apricot and peach trees were weakened by crowding and failed to yield as well, even after thinning, as trees originally set further apart. Tufts and Philp found the Eureka almond to be self-sterile but satisfactorily pollinated by either Ne Plus Ultra or Nonpareil. Rawl found the Baldwin apple self-fertile and the Yellow Bellflower to be satisfactorily pollinated by either Yellow Newtown or Delicious. Preliminary experiments by W. P. Duruz indicated that nonsetting in Napoleon, Black Tartarian, and Black Republican cherries is partially due to

the influence of secretions in the pistil on the germination of pollen grains and the development of pollen tubes. The percentage of artificial germination and the length of pollen tube growth in these varieties was stimulated by the addition of decoctions consisting of parts of pistils of another variety. In germinating Black Tartarian pollen, decoctions of Napoleon ovaries were more effective than decoctions made from the stigma or style. In the case of Black Tartarian, Black Republican, and Napoleon, decoctions of ovary, style, and stigma were slightly toxic to pollen of the same variety. Black Tartarian tubes attained a length of 49 μ in a decoction of Napoleon stigmas as compared with 13 μ in a decoction of its own stigmas. Similar results were secured with Napoleon and Black Republican. Results of pear pollination studies by Tufts and Philp are again reviewed (E. S. R., 51, p. 241). Plum pollination studies reported by Hendrickson showed Jefferson to be partially self-sterile but effectively pollinated by Sugar, and Coates 1418 partially self-sterile but successfully pollinated by either Sugar, French, or Imperial.

Almond-pruning investigations conducted by C. L. Austin continued to show the deleterious effect of severe pruning, the average trunk circumference of 5-year-old severely headed trees being 34 cm. as compared with 40.6 cm. for lightly headed trees. At 4 years of age thinned trees yielded 4 lbs. of shelled almonds, while severely pruned trees yielded 0.3 lb. and lightly headed trees 1.7 lbs. Examination of root and top development of 3-year-old pruned almond trees showed a reduction in the amount of growth directly in proportion to the severity of pruning. Measurements of the total new growth on almond trees pruned in different ways showed that headed trees put forth much more new growth than thinned trees. Long-pruned apricot trees yielded a total of 313.8 lbs. of fruit as compared with 25 lbs. for short-pruned trees. A study of the effect of early and late summer pruning upon apricots showed both operations to decrease yields. Determination at different seasons of the leaf area of long and short pruned 5-year-old apricots showed the long-pruned trees to have much the larger area during the early part, while at the close of the season the short-pruned trees had a larger area. As reported by S. H. Cameron, the heading of pear and apricot trees resulted in shoots differing markedly during the early season from those of nonheaded trees. The shoots of headed trees were stockier, bore larger and thinner leaves, and continued to elongate later in the season. In the early season the cells of current growth of headed and nonheaded trees did not differ, but in mature shoots the cells of headed shoots were usually thicker walled. Data on starch deposition and utilization are again reviewed (E. S. R., 50, p. 835). Austin found that upright growing trees could be made to take on a broader form by tying down the scaffold limbs during the first growing season. This system of training, commonly known as the Caldwell (E. S. R., 46, p. 736), was tested with success on the almond, apricot, peach, and Japanese plum. In the cherry and prune, tying down was not as successful, growth stimulation being centered at the end (cherry) and at the bend (prune). Among the advantages of the Caldwell system are listed earlier and heavier production and lessened pruning. A comparison of the yields of long and short pruned, young Japanese plums showed large increases in favor of the lightly pruned trees.

Working with 6-year-old Bartlett pear trees, Tufts found that during the months September to March there was a greater concentration of carbohydrates in the tips than in the base of shoots. A study by Tufts and Austin upon the effect of light and severe heading on pear and prune shoots showed severe pruning to be deleterious, reducing diameter increment, spur forma-

tion, and the total length of new growth. Rest period studies with deciduous fruits conducted by Hodgson are again discussed (see p. 45).

Studies by F. T. Bioletti, in which the spurs of 6-year-old Emperor vines pruned according to the unilateral horizontal cordon system were cut back to various lengths, showed the largest production of high-grade grapes on spurs bearing from 2 to 4 buds. There was no appreciable influence of length of spur on the total weight of crop. Counts of blossom clusters showed that buds on the old wood are less productive than buds on the young canes, the maximum productivity occurring apparently in buds at the second node of canes. Observations of horizontal and vertical cordons in a 7-year-old Emperor vineyard showed little difference in fruitfulness. As observed by Bioletti and A. J. Winkler, a spacing of 6 by 12 ft. was better in respect to yield and to growth than either 4 by 18 ft. or 3 by 24 ft. Cordon pruning was unfavorable to the Muscat variety at Davis. As reported by Winkler, the immersion of grape cuttings in dilute solutions of KMnO_4 , MnSO_4 , and H_2O_2 decreased the time required to start rooting and increased the number of roots. Careful selection of cuttings prior to planting greatly increased the percentage of successful rooting. Microscopic studies of grape buds, carried on by L. O. Bonnet and J. D. and W. L. Rogers, showed that in many varieties the lower buds of canes are not fruitful. In pruning rootstock vines, Bonnet found that vines pruned with a head at the ground level produced more and straighter cuttings than did higher-headed vines. A survey by H. E. Jacob and J. H. Herman showed a remarkable increase in acreage devoted to table grapes during the period 1911-1922.

Preparation of cabbage for market, C. W. HAUCK (*U. S. Dept. Agr., Farmers' Bul. 1423 (1924), pp. 2+14, figs. 18*).—Information of a general nature is offered on market types of cabbage, times and methods of harvesting, necessity of careful grading, shipping containers, methods of loading cars, handling for sauerkraut manufacture, methods of storing cabbage, and governmental inspection activities.

Spraying and dusting cantaloupes, H. H. ZIMMERLEY, R. J. DAVIS, and H. SPENCER (*Virginia Truck Sta. Bul. 45 (1923), pp. 295-313, figs. 2*).—Several important conclusions were reached as a result of studies extending over a period of five years, from 1919 to 1923, upon materials and practices for protecting cantaloupes from various fungus and insect pests. Of three spraying pressures (75, 125, and 200 lbs.) at which Bordeaux mixture was applied, the best results, both in respect to vine growth and yield, were obtained with the lowest pressure. The use of Bordeaux mixture resulted in slightly better fungus control than did copper lime dusts. The latter, however, because of their easier and more rapid application, are becoming more popular among growers. Although in 1922 and 1923 the use of fungicides, both dusts and sprays, resulted in the reduction of yield below that of check plats, the protected plats produced the more vigorous, healthy foliage and higher quality fruits. It is recommended that applications of fungicides be delayed until the vines have made considerable growth or until disease appears.

Springtails (*Sminthurus* sp.) and the cucumber beetles (*Diabrotica* spp.), found especially injurious in the early stages of the plant's existence, were best controlled by repellents. For the springtails dry ground fish scrap sowed by hand along the rows, the first application when the cotyledons were spreading apart and the second a week later, was found effective. The beetles were best controlled by at least three applications, at weekly intervals following the appearance of the true leaves, of hydrated lime or 3 per cent nicotine.

Dusting and spraying eggplants, H. SPENCER, H. H. ZIMMERLEY, and R. J. DAVIS (*Virginia Truck Sta. Bul. 47 (1924), pp. 329-347, fig. 1*).—Beginning with

a brief discussion of fungi and insects injurious to the eggplant in the Norfolk trucking area, the authors report upon the results of various experiments from 1918 to 1923, conducted with a view to testing various protective materials and methods of application. Bordeaux mixture composed of copper sulphate 4 lbs., hydrated lime 8 lbs., and water 50 gal., plus calcium arsenate 2 lbs., gave consistent results in the control of the three most important pests, namely, the fungus *Phomopsis vexans* and the potato and tobacco flea-beetles. Calcium arsenate was more effective than lead arsenate. Zinc arsenite proved a satisfactory insecticide to supplement Bordeaux mixture. Bordeaux alone without arsenicals and Bordeaux plus soap were both ineffective. On the other hand, the use of calcium arsenate, 2 lbs. to 50 gal. of water, greatly increased yields above that of the checks.

Dusting gave highly satisfactory results in 1922 and 1923, a mixture of monohydrated copper sulfate, calcium arsenate, and hydrated lime in the proportions of 16, 20, and 64 per cent, respectively, resulting in larger yields of marketable fruits than were obtained from adjacent plats sprayed with Bordeaux mixture and calcium arsenate. Without arsenicals, Bordeaux dusts were comparatively ineffective. Calcium arsenate dust was measurably useful, but did not equal the combined Bordeaux arsenate material.

Studies of spraying and dusting practices led to the recommendation that sprays be applied with outfits capable of maintaining 125 lbs. pressure, and that dusts be applied when the dew is still on the foliage. Hand dusters gave satisfactory results. It is advised that control treatments be started in the plant bed and continued at weekly intervals during the period of rapid growth. The increased yields resulting from the use of the more effective treatments were such as to fully justify their expense.

Dusting and spraying tomatoes, R. J. DAVIS, H. SPENCER, and H. H. ZIMMERLEY (*Virginia Truck Sta. Bul. 46 (1924), pp. 317-327, figs. 3*).—Comparisons in 1922 and 1923 of dusting and spraying with combined insecticides and fungicides as means of controlling diseases and insects on the tomato showed in both years slightly better yields of marketable fruits from the dusted plats. However, either dust or spray was effective in controlling the more important pests, and, since the yields from both treatments were significantly higher than those of control plats, the general recommendation is given that either spray or dust be applied regularly during the growing season. The various diseases, leaf spot, leaf mold, and wilt, and the one important insect pest, the tomato fruit worm (*Chloridea obsoleta* Hbn.) are briefly discussed in relation to their methods of attacking the tomato.

Nitrate of soda in the nutrition of the tomato, P. WORK (*New York Cornell Sta. Mem. 75 (1924), pp. 3-86, figs. 38*).—Following an earlier abridged report (E. S. R., 46, p. 538), the author herein presents a detailed discussion of work conducted at the Minnesota and Cornell Universities with a view to determining the optimum nutrient requirements of the tomato. Since preliminary studies indicated that nitrogen is much more potent than either phosphorus or potash in influencing the growth and yield of the tomato, the major portion of the study is devoted to nitrogen carriers and to nitrate of soda in particular. On the basis of total dry weight of plant and fruit, the relative adaptation of manure, urea, hemoglobin, sodium nitrate, peptone, casein, ammonium carbonate, and nothing to the tomato plant were found to be as follows: 130.7, 100, 96, 92.5, 90, 88.2, 75.9, and 28.2, respectively.

Studies in which nitrate of soda, used as the source of nitrogen, was applied in various ways and amounts to tomato plants growing in boxes of sand in which had been incorporated adequate amounts of other essential nutrients indicated the important rôle of nitrogen in the nutrition of the tomato. Gradu-

ated single applications of nitrate of soda in amounts up to 2,256 lbs. per acre resulted in increased vegetative growth and fruit production. Larger applications resulted in decreased flower and fruit formation. With small doses of nitrate, decidedly better results were obtained when the material was applied in fractional portions. However, with applications above 2,256 lbs. per acre this did not hold true. None of the amounts used in the study induced the condition of heavy vegetation and unfruitfulness.

Since no lot of plants having a nitrogen content lower than 0.3 per cent in their leaves made a vigorous vegetative growth, the author believes that this is the minimum nitrogen content for insuring satisfactory development. The relation between nitrogen content and fruit production was similar to that between nitrogen content and vegetative growth. The stems of all vigorous vegetative and fruitful plants showed a nitrogen content above 0.12 per cent, green weight basis, the maximum being 0.206 per cent. In nitrogen-starved plants the nitrogen content was usually low and that of carbohydrates high. However, there was found no apparent relationship between the two. Furthermore, no relationship was observed between the amount of nitrate in the soil and the concentration of total carbohydrates in the plant.

The carbohydrate content of leaves ranged from 0.92 to 5.97 per cent, green weight basis, and in stems from 1.42 to 8.21 per cent. Carbohydrates in the leaves of vigorous vegetative plants ranged from 0.92 to 3.66 per cent and in the stems from 1.42 to 3.3 per cent. The maximum carbohydrates were found in nitrogen-starved plants. No indication was noted that either high or low carbohydrate content inhibited vegetative or reproductive activities. The amount of carbohydrates in the plants is deemed to be the resultant of the balance between the processes of manufacture and of use, and so long as the rate of manufacture is sufficient to meet current needs the amount of carbohydrates present does not condition the processes of vegetation and fruition.

Observations on the rest period of deciduous fruit trees in a mild climate, F. R. HODGSON (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 151-155).—Data on growth renewal when placed in a warm greenhouse of cuttings of 300 varieties representing eight species taken at intervals throughout the late fall and winter showed a gradual emergence in most instances. However, there were found a few varieties in several of the species which did not appear to undergo a rest period similar to that of related plants. For example, Japanese plums ended their rest considerably in advance of the European varieties, and in the almond the rest period was so brief and feeble as to be quite uncertain. In the apple the rest period ended very late and rather abruptly. No apparent relation was noted between the presence and absence of leaves and the resting stage.

Examination of peach twigs from which the buds had abscised following etherization showed starch to have completely disappeared in the nodal region and in the callus-like layer formed at the point of abscission. On the other hand in control twigs starch was present in abundance, suggesting that etherization may have brought rapid hydrolysis of the starch.

In an attempt to determine how etherization affects the renewal of growth, determinations of starch were made in the buds of pear, peach, and cherry cuttings, exposed for varying periods to ether treatment and subsequently placed in cold and warm environments. Buds of control cuttings showed no loss of starch at the end of 14 days in either the cold or the warm chamber, whereas all of the etherized material showed a marked loss in starch under identical conditions. The loss of starch began in the distal region and gradually progressed toward the base of the buds. The decrease in starch was apparently in direct proportion to the length of the etherization period, for

in the case of abscised buds no starch was found in the bud or in the region of attachment. The fact that buds of etherized cuttings lost starch about as rapidly in the cold chamber where growth did not occur as in the greenhouse where growth did take place leads the author to believe that the breaking of the rest period may likely be the result of stimulated enzyme action.

Studies of fruit seed storage and germination, H. B. TUKEY (*New York State Sta. Bul. 509 (1924), pp. 3-19*).—Freshly gathered Chili peach kernels held for a short time in a dry, warm room failed to start in a Hottes germinator but did not lose their viability in 11 months, indicating the need of completing the after-ripening process before being able to renew their growth. During the process the kernels gained one-third to one-half in weight by the absorption of moisture. That peach pits are pervious to water, both through the sutures and the side walls, was shown in tests in which vertical and horizontal sections were placed in contact with moist plaster. Of several methods of stratification and storage tried, that one in which Chili pits were stratified outdoors in wet moss was most successful. Lots from which moisture was withheld continuously or in part failed to germinate, irrespective of the temperature. Alternate drying and wetting of pits so weakened them that they could be easily cracked. Exposure of moistened Chili pits to outdoor temperatures as low as -8° F. resulted in almost complete loss of viability. That a combination of moderately low temperature and abundant moisture favors germination was indicated when Chili pits placed in sand resting on cakes of ice cracked readily and later showed high germination. Kernels which for 11 months had laid dormant in the Hottes germinator grew readily after 30 days in the sand. Chili pits nearly one year old responded to the sand and ice treatment after 2, 4, 8, 10, and 12 weeks, by the cracking naturally of 0, 60, 70, 80, and 100 per cent, respectively.

Similar studies with cherry seeds showed these to be also readily pervious to water and capable of ready germination if allowed to go through the after-ripening process. Great difficulty was found, however, in securing good seed, abortive kernels being the rule, especially in the sweet cherry. *Prunus tomentosa* seed, on the other hand, germinated practically 100 per cent. In studies with pits of the Wild Goose (*P. munsoniana*) and Palatine (*P. domestica*) plums, the Wild Goose responded favorably to the sand and ice treatment, while the Palatine failed to germinate at all. Apple seeds gave 100 per cent germination after 8 weeks' stratification in wet sand on ice, while with the pear only 2 weeks were required to obtain similar results.

Studies with seeds of various small fruit species, including the blackberry, raspberry, currant, and gooseberry, showed that the gooseberry alone was able to germinate readily after subjection to cool, moist conditions. Treatment with sulphuric acid increased the percentage of germination in all fruits except the gooseberry, whose seeds were killed by 15 minutes' immersion. With the blackberry, increased germination resulted from 4 hours' acid treatment.

New and noteworthy fruits, VII, U. P. HEDRICK (*New York State Sta. Bul. 514 (1924), pp. 3-10, pls. 5*).—This, the seventh of a series (E. S. R., 49, p. 338) relating to promising fruits developed or tested at the station, features the Gorham pear, Seneca cherry, and Hall plum, all illustrated in color. Other fruits discussed are the Early McIntosh, Macoun, and Red Gravenstein apples, Abundance sweet cherry, Keuka grape, and the Newman red raspberry.

The development of pecan buds and the quantitative production of pollen, J. G. WOODROOF (*Georgia Sta. Bul. 144 (1924), pp. 134-161, figs. 20*).—In general continuation of studies with the pecan (E. S. R., 36, p. 344), the author reports in detail upon microscopic and macroscopic studies of bud

development, taking into consideration the kinds of buds, their position on the tree, stages of development, amount of pollen produced, and the regularity of pollen production, as well as on the staminate flower of the hickory.

Of the two classes of pecan buds, catkin and vegetative, the former are always borne on the current year's growth and in trees of bearing age constitute practically all the buds on such growth. Catkin differentiation precedes complete development by almost exactly one year. Staminate and pistillate flowers are borne separately on the same tree, but adequate pollination is insured by the production annually of an extraordinary amount of pollen. Examination of hand-pollinated stigmas showed the pollen to commence germination after 24 hours and to grow rapidly after 36 hours.

FORESTRY

[Forestry investigations at the California Station] (*California Sta. Rpt. 1923, pp. 136-144, figs. 6*).—The usual progress report (E. S. R., 48, p. 540).

Yield tables for second growth redwood prepared by D. Bruce from data taken on 135 sample plats showed that this species is capable of extremely rapid growth, producing approximately 116,000 bd. ft. per acre on the best sites at 50 years of age. Time studies of logging are again reviewed by Bruce (E. S. R., 47, p. 540). Studies by H. C. Lott upon the production and viability of redwood seed in 1922 yielded valuable information. Seed collected September 21 gave as satisfactory germination as did that taken from the same trees two months later. Maturity of seed was indicated by a yellowish color or slight separation of the cone scales. It was found that approximately 9 lbs. of green cones, averaging 227 per pound, are required to produce a pound of clean seed. The proportion of viable seed increased with the age of the parent tree up to a maximum of about 250 years. Seed from very young and very old trees had very poor germinating qualities. Large seeds were found more viable than small, suggesting the advisability of screening. Germination was not hastened by soaking in warm water or dilute sulphuric acid. Immersion for 15 minutes in water heated to 65° C. (149° F.) killed the seed. High specific gravity was not found to be an indicator of viability. Redwood seed collected in Mendocino County was much more viable than that from any other locality. Form factor and volume tables for *Eucalyptus globulus* are presented by W. Metcalf.

Grazing studies in Shasta County indicated that vegetation consisting of annual plants may, under normal temperature and soil conditions, complete its growth cycle in from 40 to 50 days after the seed has germinated, suggesting that it may be possible under favorable seasonal conditions to procure a seed crop even if grazing is continued until April 15.

Relative resistance of tree seedlings to excessive heat, C. G. BATES and J. ROESER, JR. (*U. S. Dept. Agr. Bul. 1263 (1924), pp. 16, fig. 1*).—With a view to confirming outdoor observations (E. S. R., 48, p. 641), namely, that seedlings of important forest species have markedly different heat-resisting capacities, seedlings of Engelmann spruce, Douglas fir, western yellow pine, and lodgepole pine were submitted to carefully controlled laboratory tests.

An exposure for six minutes in air practically saturated with moisture and heated to 111° F. resulted in considerable injury to 30-day-old soil-free seedlings. Injury increased with rising temperatures, until at 141° an exposure for one minute was fatal to seedlings of all four species. The exposure in dry air of seedlings 46, 64, 90, and 92 days old to direct radiation from an electric heater showed the following order of decreasing resistance: (1) Lodgepole pine, (2) western yellow pine, (3) Engelmann spruce, and (4) Douglas fir.

While some injury followed long exposure at from 120 to 130°, many seedlings were observed to survive exposure of from 170 to 180° for from 6 to 8 minutes, indicating that, under ordinary atmospheric conditions, transpiration is a potent factor in keeping down internal temperatures. The behavior of seedlings of different ages showed quite conclusively that increased age is correlated with increased heat resistance, a fact especially true for the spruce and lodgepole pine, whose seedlings are extremely small and frail in the early stages. The wilting of seedlings of all species was generally in the nature of a collapse of the stem at the ground line. The frail, shallow-rooted Engelmann spruce and lodgepole pine seedlings were much more susceptible to this type of injury than the larger, firmer, and deeper-rooted seedlings of western yellow pine and Douglas fir.

In general conclusion, it is pointed out that the results of the study show that, in the open, extreme heat must often kill seedlings which would be able to cope with lack of moisture. The relatively great ability of lodgepole pine to withstand high temperature is deemed to be the deciding factor in the establishment of this species on openly exposed, highly heated sites. Douglas fir, on the other hand, because of the low heat resistance of its leaves, is unable, unless partly shaded, to survive on southern slopes, where during the dry periods of autumn the surface soil temperatures may reach a maximum of from 140 to 150°.

Hardwood lands after logging, P. A. HERBERT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 26-30).—Studies of regeneration on cut-over hardwood lands in the vicinity of Johannesburg, Mich., indicated that adequate reproduction may be secured under present methods of cutting, provided fire is excluded. Determinations of the age of reproduction on an unburned area showed less than 5 per cent due to seeds shed from trees remaining after logging, leading to the belief that little is gained by leaving any trees at logging time, provided fire is kept out subsequently. A comparative study of reproduction on unburned and burned areas showed the evil results of fire in loss of humus, in production of weeds and underbrush, and in the establishment of less desirable forest species such as pin cherry, willow, and aspen.

DISEASES OF PLANTS

Plant pathology (*California Sta. Rpt.* 1923, pp. 179-187, figs. 5).—E. H. Phillips and E. H. Smith have shown that to a large extent the principal diseases of the fig start from infection inside of the fruit and not from the exterior, and so far as their investigations went the inside of the fig was completely sterile until it had been entered by insects. The comparative immunity of certain fig varieties to smut, souring, and decay is considered to be due simply to the fact that they have a tightly closed eye and a solidly filled interior, thus making difficult the entrance of insects. One of the most important factors in connection with these diseases is found to be the dried fruit beetle (*Carpophilus hemipterus*). P. D. Caldis has also shown the possibility of the Blastophaga being an important carrier of fig disease germs.

A brief account is given of an improved method for making nicotine dust in which previous difficulties have been obviated by the development of a self-mixing dusting machine. The raw materials are placed in the machine in the field and the mixing and application carried on at one operation.

Considerable trouble is reported with canning tomatoes, and an extensive survey made by F. L. Yaw indicated that the principal diseases are Fusarium wilt, western blight, and degenerate strains producing misshapen fruit of poor

canning quality. Experiments are in progress in a number of localities testing varieties and strains which are thought promising for avoiding these troubles.

J. P. Martin has carried on an investigation with winter injury and sour sap disease in deciduous fruit trees and found that several diseases or injuries were confused under the name of sour sap; included among these are the bacterial gummosis caused by *Pseudomonas cerasus*, and various injuries which are due to climatic or soil conditions. Coating trees with whitewash early in the winter was found to prevent some forms of sour sap, including bacterial gummosis. Cold water paint was also found to be a good material for this purpose. Top-grafting trees at least 3 ft. from the ground on resistant stocks was found to have protective value to all forms of winter injury. Trees regularly sprayed in the fall and spring with Bordeaux mixture showed some evidence of the control of bacterial gummosis.

Studies by B. A. Rudolph of the brown rot fungus (*Sclerotinia cinerea*) indicate that it is unable to make its attack upon the blossoms of apricots in the absence of moisture. Observations made after several foggy nights and mornings that occurred during the blooming season showed serious outbreaks of the disease in unsprayed orchards. Where orchards were given two or more applications of a 8-8-50 Bordeaux mixture good control was obtained. Spraying experiments for the control of brown rot in ripe fruit indicate that fungicides which leave a precipitate or deposit on the fruit can not be used late enough to control the disease without rendering the fruit unfit for cannery use.

E. H. Smith reports a serious disease of raspberries due to a *Verticillium*, which attacks the canes near the surface of the ground and is spread by cuttings. The same author reports a number of minor diseases of apple and pear, among them *Monilia* sp., which causes a blighting of blossoms and new growths; *Botrytis* sp., causing twig die-back of pear; and *Plenodomus fuscomaculans*, causing apple bark cankers.

Smith reports that since lesions suggestive of the eastern black spot are prevalent, appearing as leaf and fruit spotting and cankering on the new shoots of stone fruits, a comparison was made of the black spot bacterium (*Bacterium pruni*) with certain yellow organisms associated with the California lesions. The true black spot has not been found, the damage above mentioned being caused by the bacterial gummosis organism (*Pseudomonas cerasus*).

W. T. Horne has investigated apple sappy bark, and his examination showed a peculiar exudation of dark-colored sap forced out of openings through the bark. Accompanying this was an active decay of the sapwood associated with a fungus which is not positively identified.

The same author reports additional investigations on the *Armillaria* disease or oak root fungus, for the control of which carbon disulfide has been successfully used. The use of resistant stocks is recommended wherever possible, and annual winter inspection and scraping away rhizomorphs and diseased bark and then painting the wound with Bordeaux mixture is recommended.

Seed treatments [trans. title], W. GABEL (*Angew. Bot.*, 5 (1923), No. 2, pp. 74-76).—Description, analysis, and evaluation are given of some seed treatments, mainly proprietary.

Relative susceptibility of races and varieties of Indian corn to smut (*California Sta. Rpt.* 1923, pp. 63, 64).—A report is given of a study made by J. F. Duggar of the susceptibility of various varieties of dent, flint, soft, pop, and pod races of corn, in which he found a minimum amount of smut on the ears of two varieties of soft corn and three of dent corn. Other varieties appeared to limit the occurrence of smut to a few grains near the place of infection.

[Wheat smut investigations] (*California Sta. Rpt. 1923*, pp. 68-70).—W. W. Mackie and F. N. Briggs report experiments on the resistance of wheat to stinking smut or bunt, the method used being that known as the surviving plant method, in which strains of spring wheat are repeatedly exposed to heavy infection and the surviving plants used for seed of a subsequent crop. A number of strains of spring wheat have been developed that are more resistant to smut than the original parent. Two strains of winter and one of spring wheat have been developed that appear to be immune to smut.

A test of hybrid seed of crosses made between two immune strains of winter wheat are said to indicate that smut resistance is dominant in these crosses.

Control of stinking smut or bunt of wheat, G. H. COONS (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 21-24, fig. 1).—Suggestion is given for the use of copper carbonate for the control of the stinking smut of wheat, the author recommending that it be used at the rate of 4 oz. per bushel.

In connection with studies on wheat smut a large number of varieties of wheat have been tested, none of which proved smut resistant to an extent sufficient to warrant their being planted without treatment. One variety, Berkeley Rock, a hybrid wheat, has proved sufficiently resistant to need no treatment before planting.

The copper carbonate dust method of controlling bunt of wheat, L. E. MELCHERS and H. B. WALKER (*Kansas Sta. Circ.* 107 (1924), pp. 14, figs. 5).—Directions are given for the use of copper carbonate for the control of wheat smut, and attention is called to the fact that the fineness of the copper carbonate is as important as its chemical constituents. At least 90 per cent of the dust should pass through a 200-mesh screen. Where seed are badly smutted it is suggested that the standard formaldehyde treatment would be more effective than the copper carbonate method.

Detailed directions are given for the construction of a smut-treating machine.

Nematode investigations (*California Sta. Rpt. 1923*, pp. 147, 148).—W. S. Malloch is reported to have found 63 varieties of cantaloupes and 97 varieties of tomatoes susceptible to nematode attack. In addition he found the following varieties of cowpeas to be attacked by nematodes: New Era, Blackeye, Whippoorwill, Iron, and Brabham. A list of species of plants found to be attacked by nematodes is included in the report.

Cabbage seedbed diseases and Delphinium root rots: Their relation to certain methods of cabbage maggot control, W. O. GLOYER and H. GLASGOW (*New York State Sta. Bul.* 513 (1924), pp. 3-38, pls. 6).—Attention is called to the fact that screening cabbage seed beds for the control of the cabbage maggot favors the development of certain diseases, especially those due to *Rhizoctonia solani* and *Plasmodiophora brassicae*. Applications of tobacco dust, while effective against cabbage maggot, resulted in increased prevalence of *Rhizoctonia*, the fungus growing readily on the tobacco dust. Experiments with corrosive sublimate solutions showed that the diseases as well as the maggots were almost completely controlled. Acidulated corrosive sublimate was more toxic to the plants and on limestone soils was not as effective as the nonacidulated solution.

In connection with the above experiments the authors investigated the effect of similar treatments for the control of a sclerotial root rot and a bacterial blight of Delphinium. The root rot was completely controlled, and it is believed that the treatment described materially reduced the bacterial blight.

Control of cucumber mosaic in the greenhouse, S. P. DOOLITTLE (*U. S. Dept. Agr., Dept. Circ.* 321 (1924), pp. 6., pls. 2).—Suggestions are given for the control of cucumber mosaic in greenhouses, the treatment being based on fumi-

gation for the repression of insects which may act as carriers of the infection, and the roguing of the plants as soon as they are observed.

The influence of locality of origin on potato leaf roll [trans. title], E. GRAM (*Angew. Bot.*, 5 (1923), No. 1, pp. 1-20, figs. 9).—Besides an account of a study of locality of origin, soil, manuring, cultivation, weather, and climate as related to potato leaf roll in different places, the results of selection are shown. From this it appears that land free from leaf roll tends to remain so, and that sick seed on such land or on sick land can be at least measurably freed from leaf roll by selection.

Common scab of potatoes, Part II, W. A. MILLARD (*Ann. Appl. Biol.*, 10 (1923), No. 1, pp. 70-88, pls. 2).—In an account of experiments on the remedial measures for common scab given by the author in a report recently noted (*E. S. R.*, 44, p. 344), it was shown that the disease may be inhibited by green manuring, and that where it is possible to apply a sufficient quantity of green organic matter and to work this into a very intimate mixture with the soil scab may be entirely prevented. In these experiments, the green manuring was carried out, for the most part, by the addition of grass cuttings. The first section of the present paper describes some trials of plowing under a green crop, and gives an account of further experiments in which hay and spent hops were tried as substitutes. The second section deals with the effect of liming and green manuring on scab. In the third section an attempt is made to show that deductions previously drawn from evidence involving the relation between soil reaction and scab incidence are fallacious, and the various theories put forward to account for the occurrence of scab and its cure by green manuring are considered.

It is claimed that common scab consists of a number of types which vary considerably in general appearance, the two most marked types being called raised and pitted, respectively, and the other types being intermediate between these extremes. The causal organism in all cases examined belongs to the genus *Actinomyces*. The different strains isolated exhibited considerable differences in culture, but for the present they may be placed in a single group, *A. scabies*. The incidence of scab is closely associated with soil type, the disease occurring most commonly and with the greatest virulence on light sandy or gravelly soils, but rarely on peat soils.

The disease may be inhibited by the application of sufficiently liberal dressings of green manure to the soil. Spent hops also proved to be of value in this respect, and leaf mold has long been used by gardeners with good results. The action of lime or chalk on scab production depends largely upon the initial reaction of the soil. On neutral soils it causes little or no effect, but on distinctly acid soils it tends to produce or to aggravate the disease unless the soil contains a large reserve of vegetable organic matter.

The H-ion concentration of the soil is not the direct factor of control in the occurrence of scab. The disease is found to a slight extent only in soils of high H-ion concentration, yet it may occur, and the scab organisms have been found in large numbers in soils having a pH value as low as 4.4. In more nearly neutral soils no relation appears between the H-ion concentration of the soil and the occurrence of scab.

In the treatment of scab by green manuring, any change brought about in the soil reaction appears to be toward a decrease rather than an increase in the pH value.

The established facts concerning the common occurrence of scab on light soils, its comparative absence on peat soils, the action of lime, and the cure of the disease by green manuring may be explained by the preferential food hypothesis, according to which the scab organisms are primarily saprophytic,

living on vegetable remains in the soil, and remaining so until the natural food supply is exhausted, then developing their parasitic tendencies only under the stress of need. Scab is more prevalent in dry than in wet seasons. This is probably due in some small degree to the higher soil temperature obtaining in dry seasons. The climatic factor of greatest importance, however, would seem to be rainfall, which modifies the air content of the soil and thus regulates the development of the scab organisms, which are strongly aerobic. The effect is most marked in clay soils, in which scab is almost entirely inhibited during a wet season.

Studies in bacteriosis.—VIII, Further investigation of the "stripe" disease of tomato, S. G. PAINE and W. F. BEWLEY (*Ann. Appl. Biol.*, 10 (1923), No. 1, pp. 89-95).—The results of investigations on tomato stripe disease, previously shown to be associated with an organism at least closely related to *Bacillus lathyri*, have been noted (E. S. R., 44, pp. 543, 647; 46, p. 447). The present paper deals with the results of cross inoculations of tomato stripe organism into other plants. "The organism which produces 'stripe' disease of the tomato is shown to be the cause of a number of 'streak' diseases of other plants, namely, sweet pea, culinary pea, broad bean, French bean, red clover, lucern, lupine, vetch, sainfoin, and potato."

[**Deciduous fruit disease investigations**] (*California Sta. Rpt.* 1923, pp. 189, 192-194, 198, 199, 201-203, 206-208, figs. 6).—The chlorosis of pears and raspberries is briefly described, and investigations by A. H. Hendrickson show that ferrous sulfate applied next to the roots caused the foliage to turn to a normal green color. Raspberries so treated in the early spring were also immediately benefited.

In a study of bitter pit of apples in cold storage, J. L. Fidler found bitter pit to be the limiting factor in the cold storage of certain varieties of apples. One season's observation showed that summer apples were less resistant to bitter pit than fall and winter ones. Apples matured when harvested developed less bitter pit in cold storage than immature ones, and large specimens of each variety showed more bitter pit in cold storage than medium or small-sized fruit. Less bitter pit was observed on Gravenstein apples produced on sandy loam soil than on fruit from either the river bottom or bench land soils. Less bitter pit resulted in apples stored at 32° F. than in those stored at either 36 or 45°. No evidence was obtained to indicate that the age of the trees materially affected the subsequent development of bitter pit in storage.

The same author, studying apple scald in cold storage, determined the relative susceptibility of a considerable number of varieties to scald when stored at 32, 36, and 45°. Immature apples were found to scald much more severely than mature ones, and the side of the fruit which was most immature, as indicated by less color, scalded first.

Investigations of factors influencing the development of internal browning have been continued by Overholser, A. J. Winkler, and H. E. Jacob. The principal results of these investigations have been noted elsewhere (E. S. R., 51, p. 52).

Preliminary studies by Overholser and L. P. Latimer have shown that pear scald in cold storage results in a dark brown or blackened condition of the skin, which is generally localized at first but finally involves the entire surface of the fruit. Pears placed in cold storage at temperatures of 30, 32, 36, and 45° developed considerable scald, while fruit not placed in cold storage, but ripened at room temperature, did not develop scald, but such fruit failed from internal breakdown, wilt, or rot. With all varieties of pears susceptible to scald, fruit harvested when properly matured was less subject to scald than that harvested when relatively green or overripe.

The same investigators made a study of blue mold upon pears in storage, and found that the fungus (*Penicillium expansum*) was present at temperatures of 30° or higher. The germination of the spores and the growth of the mycelium were retarded at 30 and 32°, but considerable damage resulted from its presence in pears stored at 36° or higher.

An investigation on the effect of ammonia fumes upon pears in cold storage was carried on because of the fact that ammonia is largely used in refrigeration, and leaks occur in plants from time to time. Pears are said to contain a substance which becomes dark when alkaline, and the effect of ammonia fumes is described at some length. The presence of moisture on the fruit is said to increase the seriousness of the effects of ammonia fumes.

Experiments for the control of pear blight canker by the scarification method, conducted by L. H. Day, have shown that control will depend on the thoroughness in which the outer bark is pared away, paring nearly to the cambium in bark thickening in crotches and old scars, and operating before the cambium is injured extensively by the disease. For sterilization purposes cyanide of mercury and corrosive sublimate, 1 part of each by weight to 500 parts of water which contains 3 parts of glycerin, is said to have given very good results.

Plant disease investigations at the Citrus Experiment Station (California Sta. Rpt. 1923, pp. 96-98, fig. 1).—Continued investigations of E. T. Bartholomew on the *Alternaria* rot of lemons (E. S. R., 48, p. 543) are said to have shown the occurrence of this disease in all lemon-growing districts of southern California. His investigations have indicated that the initial infection of the button took place very early, probably at the time of the withering of the petals and the tips of the calyx. Further investigations have shown that the young stems below the buttons may become infected at an early stage, and it is thought possible that the presence of the *Alternaria* in the stems may be one of the factors causing the excessive dropping of the young fruits.

As a result of his investigations, the author believes that *Alternaria* rot in lemons can not be controlled by the use of sterilizing solutions in the packing houses.

C. O. Smith tested various *Prunus* stocks for resistance to crown gall and found that the most promising species from their desirability as stocks were *P. pumila*, *P. umbelata*, *P. domestica*, *P. mume*, *Amygdalus tangutica*, *P. besseyi*, *P. angustifolia*, *P. mexicana*, *P. persica*, and *P. cerasifera* in the order named. The Japanese apricot (*P. mume*) proved strongly resistant to crown gall. While none of the common species was entirely resistant, the evergreen species experimented with were completely immune to artificial inoculation. Field trials confirmed the value of *P. mume* as stocks for apricots and plums, but for peaches and almonds similar results have not been secured. *P. angustifolia* proved a good stock for all classes of stone fruits, and *P. besseyi* is considered as promising.

The author also found by artificial infection that slight variation in susceptibility occurs in varieties of walnuts resistant to the walnut blight.

Cherry troubles in western Washington, A. FRANK (Western Washington Sta. Bimo. Bul., 12 (1924), No. 3, pp. 69-72, fig. 1).—A popular description is given of a number of the common diseases which affect the cherry in western Washington, and suggestions are given for their control so far as definite means are known.

Black root of strawberry, G. H. COONS (Michigan Sta. Quart. Bul., 7 (1924), No. 1, pp. 25, 26).—Attention is called to a disease of strawberries which is characterized by the roots turning black and the cortex becoming loosened and

peeling readily from the center of the root. The crown of the plants may also be blackened. Affected plants frequently bear a crop but die during the warm summer weather. The only fungus thus far distinctly associated with the disease is said to be a species of *Rhizoctonia*, and it is thought that possibly the fungus may be an important factor in black root.

For the control of this disease the rotation of crops is recommended. For a plat badly affected the improvement of general conditions to stimulate new root formation is suggested. In making new plantings the plants should be secured from uninfected sources.

Citrus disease control (*California Sta. Rpt. 1923, p. 405*).—In cooperative demonstration work carried on by various county agents and others it has been shown that spraying before November 1 with a 5-5-50 Bordeaux mixture proved efficient in controlling citrus blast, and scraping the bark over areas infected with scaly bark has given good results.

Further studies on the relative susceptibility to citrus canker of different species and hybrids of the genus *Citrus*, including the wild relatives, G. L. PELTIER and W. J. FREDERICH (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 227-239).—In continuation of previous progress reports on investigations relating to the susceptibility to citrus canker (*E. S. R.*, 43, p. 848), the authors give an account of additional species and varieties that have been successfully infected, and in some cases they have modified their previous conclusions.

Relation of environmental factors to citrus scab caused by *Cladosporium citri* Masee, G. L. PELTIER and W. J. FREDERICH (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 241-254, figs. 2).—The results are given of cooperative experiments carried on between the Alabama Experiment Station and the U. S. Department of Agriculture on the conditions favoring the development of citrus scab. Three essentials are considered for successful infection of citrus plants under controlled conditions. These are the presence of free moisture, young growth, and temperatures between 15 and 23.5° C. The optimum for the best development of scab is said to be about 20 to 21°. Under Alabama conditions, temperatures favorable to optimum infection are said to prevail usually during parts of April and May. Any environmental factor or factors including a slight spring growth and rapid maturation or late starting favor escape from scab, while factors inducing a large amount of spring growth and slow maturation favor scab susceptibility.

The authors state that conditions essential for an epidemic scab year in Alabama depend to a large extent on a late season, coupled with sufficient moisture and the development of spring growth at the time optimum temperatures for infection prevail. An early season is said to be favorable to scab escape, in that the first growth is about completed when optimum conditions for infection are at hand.

It is claimed that under Alabama conditions a light or bad scab year can be predicted to some extent by the mean temperature prevailing in March, a temperature below normal indicating a bad season, while a temperature above normal is usually followed by a light scab year.

Bacterial leafspot of *Delphinium*, M. K. BRYAN (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 261-270, pls. 4).—A black spot of *Delphinium* due to *Bacterium delphinii* n. comb., which is said to be widespread in the northern part of the United States, is described. The bacteria are reported to gain entrance to the plants through the water pores and stomata, causing irregular tarry black spots on the leaves and sometimes on the stems and flower buds. The organism has been isolated and successful infections obtained by spraying with water suspensions from single colonies.

For the control of the disease it is suggested that all infected material be collected and burned, and that the surrounding soil and early leaves be sprayed with Bordeaux mixture.

A technical description of the organism is given.

The effect of heat upon the mycelium of certain structural-timber-destroying fungi within wood, W. H. SNELL (*Amer. Jour. Bot.*, 10 (1923), No. 8, pp. 399-411, fig. 1).—The present paper, a more technical account of a previous publication (*E. S. R.*, 47, p. 451), gives the results of a series of tests upon the resistance to moist and dry heat of the mycelium of certain wood-destroying fungi within wood, also a discussion of the application of these results to the heat treatment of decayed timber in buildings and to the kiln drying and preservation of wood. The fungi found to be of importance in the decay of mill timbers were *Lenzites sepiaria*, *L. trabea*, *Trametes serialis*, *T. carnea*, and *Lentinus lepideus*. The tests were made at varying temperatures upon blocks of Sitka spruce $\frac{3}{4}$ by $\frac{3}{4}$ by 1 in., taken from 4-months and 1-year-old cultures.

In moist heat the most resistant of the fungi was killed in $3\frac{1}{2}$ days at 44°C . and in 12 hours at 55° . In dry heat 20 days at 70° did not kill the most resistant nor did 12 hours at 100° , though all were killed in 12 hours at 105° dry heat. Individual differences appeared in the resistance of the various fungi and the individual curves showed no direct relation to the thermal growth curves. *Lenzites sepiaria* has the highest optimum and maximum of growth but next to the lowest thermal death curve. *L. trabea* is by far the most resistant, although its thermal growth relations are about the same as those of the other three fungi.

It is concluded even from the results upon small blocks that heat applied to buildings as a sterilizing agent can be of little avail against the five fungi tested, although it is pointed out that periodic heatings of such structures might be of service in checking the decay through drying out of the timbers. Heating before structures are painted or occupied is recommended. Inasmuch as the five fungi tested are the most common destroyers of structural timber and are more resistant to heat than the dry-rot fungi (*Merulius* spp. and others), it is concluded that various kiln-drying and wood-preserving processes should sterilize the wood treated, inasmuch as the data show that sufficient heat is applied in most, if not all, cases to accomplish this result.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Game laws for the season 1924-25, G. A. LAWYER and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul.* 1444 (1924), pp. II+38).—This is the twenty-fifth annual summary (*E. S. R.*, 50, p. 150) of Federal and other game laws and regulations.

Laws relating to fur animals for the season 1924-25, F. G. ASHBROOK and F. L. EARNSHAW (*U. S. Dept. Agr., Farmers' Bul.* 1445 (1924), pp. II+22).—This is the tenth annual summary (*E. S. R.*, 50, p. 252) of the laws relating to fur animals.

Occurrence of *Leptospira icterohemorrhagiae* in wild rats of Baltimore, G. H. ROBINSON (*Amer. Jour. Hyg.*, 4 (1924), No. 4, pp. 327-329).—A limited number of examinations made by the author tend to show that about 7 per cent of the wild rats of Baltimore are infected with *L. icterohemorrhagiae*. He finds that dark field examination of kidney emulsions will give a larger percentage of positive findings than guinea pig inoculation, and that certain strains are without virulence for guinea pigs. It is said that the carrier condition can be produced in white rats, and that the *Leptospira* retain their

virulence undiminished after at least four months in the white rat. The carriers are most likely to be large, full-grown animals.

A device for inflating larvae, F. H. MOSHER and J. E. R. HOLBROOK (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 408-411, pl. 1).—This is an account of the apparatus and accessories used at the gipsy moth laboratory of the U. S. D. A. Bureau of Entomology. The outfit, consisting of an oven and air pressure pump, is described and illustrated.

The use of skim milk in the preparation of certain spray materials, R. H. ROBINSON (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 396-400).—This is a contribution from the Oregon Experiment Station, in which the author outlines a method for the use of milk or milk powder in preparing a substitute for the different sulfur sprays used as summer fungicides. A mineral oil emulsion which may be prepared by using skim milk and hydrated lime as an emulsifier is described. The value of skim milk, any of the condensed milks, or milk powder as a spreader is emphasized. It is pointed out that these products will improve the spreading properties of the spray as well as calcium caseinate and at a much lower cost.

Choose sprays carefully, H. F. WILSON and C. L. FLUKE (*Wisconsin Sta. Bul.* 366 (1924), pp. 12, figs. 3).—This is a practical account, in which attention is called to the qualities that an ideal insecticide should possess.

[Insect enemies of the cherry in western Washington], A. FRANK (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 3, pp. 72-74, fig. 1).—The insects briefly considered include the shot hole borer, fruit maggot, cherry slug, bud moth worms, and aphids. A spraying program for the cherry follows.

[Entomological investigations at the California Station] (*California Sta. Rpt.* 1923, pp. 98-101, 120-132, 174, 206, 404, 405, 413, 414, figs. 11).—Spraying and dusting experiments for control of the codling moth in walnuts, conducted under the supervision of H. J. Quayle in four orchards in the Carpiniteria section and two near Tustin, confirm and emphasize the findings of the previous years, that spraying is more efficient than dusting and may be even less expensive. In the sprayed plats 8.3 per cent and in the dusted plats 16.91 per cent of the nuts were wormy, while in the check plats 21.78 per cent were wormy. The average cost per tree for spraying was 41.23 cts. and for dusting 55.45 cts.

In fumigation with calcium cyanide dust, by Quayle, H. Knight, and F. C. Greer, citrus trees infested with black, citricola, and red scale were entirely freed, and no injurious effects resulted in dry weather. When the dust is discharged under a tented citrus tree by means of a suitable dusting machine it fills the entire tent, and a killing concentration is maintained throughout the entire exposure. The gas is generated gradually and uniformly in all parts of the tent at once, reaching its highest concentration in about 40 minutes.

The dusting of grapevines at Oasis, Coachella Valley, by Knight and Greer, for control of grape leafhoppers, with pulverized calcium cyanide and hydrated lime with proportions of 10, 25, 50, and 100 per cent cyanide, resulted in the destruction of all nymphs and a large proportion of the adults when used above a strength of 10 per cent, and no injurious effects to the vines were observed. Tests of calcium cyanide in flake and dust form by Quayle, Knight, and Greer indicate that this material is well adapted to soil fumigation, the woolly aphid and other soil-infesting insects being killed by the use of 2 oz. to the square yard. Applied directly to the trunk of the tree and well covered with dirt, 2 oz. gave satisfactory results against the peach borer, and no injurious effect on the trees was observed.

Comparative spraying tests in San Diego County, by Quayle and Knight, indicate that lime sulphur and sulphur sprays do not give as good results in

controlling red spider in that section as do some of the miscible oils. In order to test the effect of temperature on the resistance of insects to fumigation, coccinellid beetles were treated with hydrocyanic acid gas at temperatures ranging from 24 to 36° F. from 12 to 24 hours. Approximately 56.7 per cent of the cold beetles and 93.46 per cent of the warm beetles were killed. In similar tests with scale insects, by Knight and Greer, lemons infested with red scale and potted oleander cuttings infested with black scale were exposed to uniform temperatures of 30 and 40° for 72 hours, some being removed at 12, 24, 48, and 72 hours, respectively. At the expiration of 12 hours, 17.4 per cent of the beetles were killed at 30° and 15.7 per cent at 40°, 85.48 per cent of the red scale were killed at 30° and 98.55 per cent at 40°, and 84.32 per cent of the black scale were killed at 30° and 100 per cent at 40°. The check, not fumigated, showed at the end of 12 hours that 54.7 per cent of the red scale and 50 per cent of the black scale were killed at 30°. After 24 hours, 11.4 per cent of the beetles were killed at 30° and 28.1 per cent at 40°, 88.32 per cent of the red scale were killed at 30° and 99.39 per cent at 40°, and 95.56 per cent of the black scale were killed at 30° and 100 per cent at 40°. The check showed 82.1 per cent of the red scale and 93.13 per cent of the black scale killed at 30°.

During the year approximately 3,000 lbs. of paradichlorobenzene were applied in doses of from 0.75 to 1 oz. to apricot trees in Alameda and Santa Clara Counties, under the direction of E. O. Essig and J. F. Lamiman, for the control of the peach-root borer (*Aegeria opalescens* Edw.). The results were entirely satisfactory, and so encouraging that practically the entire acreage of infested apricot, peach, and other fruit trees was to be treated similarly in the fall of 1924. In not a few cases it was applied as late as December and remained throughout most of the winter, killing many of the borers and doing no damage to the trees. In one nursery a large number of 1-year-old peach buds were treated without injury.

The use of crude carbolic acid emulsion and miscible oils for control of the mealybug on pear trees, as recommended by Essig the previous year (E. S. R., 48, p. 551), was continued in the Santa Clara Valley with marked success. Two or three applications during the winter months are said to assure a clean-up the following season. The use of paradichlorobenzene for control of the root form of the woolly apple aphid was continued in Sonoma and Santa Clara Counties, and the percentage of infestation reduced from 75 to 95 per cent in most cases, with no serious effects on the trees. The amounts applied were from 0.75 to 1 oz. for 4 to 6-year-old trees and 2 oz. for large, mature trees. Continued use of paradichlorobenzene for control of the pear root aphid gave the same success as reported the previous year by Essig, and the treatment of a large acreage in Contra Costa County resulted in thorough control without killing a single tree.

The fact that apples in northern Santa Clara County are subject to infestation by codling moth, so heavy that it frequently affects from 50 to 65 per cent of the crop, is attributed in large part to the irregularity with which the first brood moths emerge. The life history as worked out during the year by Lamiman showed that the first brood moths were still emerging on June 15, while the first of the second brood larvae were pupating the latter part of June. This indicates an oviposition period for the first brood moths lasting from May 15 to some time in July. Oviposition of the second brood moths began the second week in August and continued through September.

The garden centipede, *Scutigera immaculata* (Newp.), was injurious to asparagus, the white or canning asparagus being especially subject to injury

by its feeding on the tender shoots below the surface of the soil. Life history studies of the pest are under way, as are field experiments with soil fumigants and repellents. Observations by F. H. Wymore of the artichoke plume moth, *Platyptilia carduidactylia* Rll., during the year have shown that the careful removal and destruction of all infested artichoke heads reduces the infestation to a minimum and offers the most economical means of field control. Field experiments with 5, 7, 8, and 10 per cent nicotine sulfate for control of the pea aphid showed the 8 and 10 per cent nicotine sulfate to be very satisfactory as a control measure. A control of the pea aphid of approximately 90 per cent was secured with dusts containing 75 and 100 per cent of calcium cyanide containing 20 per cent cyanogen, but the foliage was slightly injured in both cases. A 50 per cent dilution of the dust gave an estimated control of 75 per cent without injury to the foliage.

Three predacious bugs are said by W. J. Hartung to prey on the beet leafhopper, namely, *Neides muticus* (Say), *Zelus socius* Uhl., and *Nabis kaimii* Rent. The Argentine ant is said to enter the cages in greenhouses and kill the nymphs and occasionally the adults and carry them to their nests. The green lacewing larva (*Chrysopa californica* Coq.) devours the hopper, and specimens of *Geocoris pallens* Stål collected in beet fields were frequently seen sucking out the juices of the nymphs and adults in cages. Egg parasites bred from the eggs of the beet leafhopper in the San Joaquin Valley include *Poly-nema eutettixi* Gir., *Anagrus giraulti* Craw., *Aphelinoidea plutella* Gir., and *Anthemiella rex* Gir. The dipterans *Pipunculus vagabundus* Knab and *P. industrius* Knab were reared from beet leafhoppers, as was a wingless antlike wasp (*Gonatopus contortulus* Patt.) and the winged male. "The average percentage of parasitized adults of various broods of *Pipunculus* and *Gonatopus* was as follows: Winter brood adults collected on plains and foothills 4.4 to 8.2 per cent, winter brood adults captured in cultivated areas 28 per cent, spring brood adults taken on plains and foothills 1 to 1.5 per cent, spring brood adults caught in cultivated regions 3.5 per cent, summer brood adults collected in cultivated districts 10 to 32 per cent."

It is pointed out that field and laboratory experiments have demonstrated beyond any question of doubt that curly leaf is not transmitted through the soil or from beet to beet. One-half hour at a mean temperature of 103.5° F. was the shortest time required for the infective principle of curly leaf to travel through a beet petiole 7 in. long. Infective beet leafhoppers were placed on a beet seedling, feeding only on one of the outer or oldest leaves, and at the same time noninfective hoppers placed on the inner or youngest leaf of the same beet became infective at the end of two days, as was proved by transferring them to a healthy beet. Evidence accumulated during the past few years indicates that curly leaf is not produced by a toxin injected into the sugar beet by the beet leafhopper, and it has been impossible to eliminate the incubation period in the insect. "Leafhoppers with an incubation period of 1, 2, and 3 days transmitted curly leaf to 66.6, 85.2, and 88.8 per cent of the beet seedlings; compared with the result, 7.9 per cent incubated for a period of 4 to 10 hours. The minimum incubation period in the sugar beet was reduced from 3 to 2 days in small beet seedlings."

A severe outbreak of bark beetles of pine and cypress, namely, the red turpentine beetle, *Ips radiatae* Hopk., and *I. phastographus* Lec., which killed a large amount of standing timber in Monterey County, was checked by cutting and destroying the infested timber before the spring flight of the beetles, under the direction of E. C. Van Dyke. Creosoting the base of power-line poles was found to be a good protection against the termite *Reticulitermes hesperus* Banks, which attacks the base of the pole buried in the ground.

The termite *Kaloterms minor* Hagen, which feeds on the top of the pole, honeycombing the upper part and at times the entire pole, is more difficult to combat, since creosoting the base is no protection against its entrance. It is recommended by Van Dyke that the entire upper portion of the pole be painted with an arsenical solution.

Studies of control work by S. B. Freeborn with roundworms of poultry showed nicotine to be the most satisfactory drug for eliminating these worms. "Tobacco dust which contains from 1.5 to 2 per cent nicotine fed as 2 per cent of the dry mash daily for three or four weeks removes approximately 100 per cent of the large intestinal worms (*Ascaridia galli* Schr.) and 85 per cent of the cecum worms (*Heterakis gallinae* Gme.) Nicotine sulfate used with the food or water of the birds is not acceptable, but combined with Lloyd's Alkaloidal Reagent at the rate of 6.6 cc. to 16 gm. of the reagent and administered in single doses of 350 mg. (No. 2 gelatin capsule), the single treatment is nearly 100 per cent effective for the large worms (*Ascaridia*), though it is ineffective for the cecum worms (*Heterakis*). Rectal injections of 10 cc. of 0.5 per cent solutions of nicotine sulfate (40 per cent nicotine) in distilled water removes 85 per cent of the cecum worms."

Acidifying tobacco dusts with sulfuric and hydrochloric acids reduced the loss of from 12 to 14 per cent of their nicotine content, which takes place in one month when stored in open sacks, by approximately one-half. The most stable carrier for nicotine was found by E. R. de Ong and Freeborn to be an aluminium silicate known as Lloyd's Alkaloidal Reagent. "The increased toxicity of free nicotine over that combined with an acid, as shown in insecticidal experiments, was confirmed by tests on the chicken, for 100 mg. of nicotine sulfate could be given with impunity in distilled water, while 10 to 65 mg. of free nicotine caused death. A dosage of 3 mg. of free nicotine was the minimum at which death might occur.

"A close correlation between the volatility and toxicity of nicotine has been shown by E. R. de Ong. Experiments with nicotine sulfate solutions in distilled and tap water, with and without the addition of varying amounts of alkali, have shown an increase in toxicity to aphids corresponding to the degree of alkalinity present. Solutions containing sufficient alkali completely to free the alkaloid nicotine from the sulfuric acid showed an average increase in efficiency of 22.7 per cent by spraying and 40.3 per cent by fumigation experiments over neutral or acid solutions of nicotine sulfate. Fumigation experiments with the same solutions used in spraying showed an efficiency curve that closely paralleled that of spraying. This indicates that the insecticidal action of nicotine is due to the volatile portion, and that it is a 'respiratory' rather than a true contact poison. . . . In clear, dry weather 38.1 per cent more nicotine was recovered from foliage sprayed with a neutral solution than was found by spraying with nicotine in alkaline solutions. During cloudy, rainy weather a difference of 67.1 per cent was found."

Spraying and dusting experiments with *Derris* spp., by L. T. White, showed an extract known as Derrisine to be unsatisfactory as an aphicide. Dilutions of from 1 to 300 were 68 per cent efficient, while from 1 to 500 gave a control of but 50.5 per cent. It was also found inefficient against the common red spider. A dust made from ground *Derris* root mixed with 80 per cent of inert carrier was found by White to give perfect control of the biting lice, *Menopon biseriatum* Piaget and *Goniocotes gigas* Tasch., of the fowl and of the sucking lice, *Gyropus ovalis* Nitz, and *Gliricola porcelli* L., of the guinea pig.

A study by de Ong of the native species of California bees, including the bumblebee (*Bombus* spp.), carpenter bee (*Xylocopa* spp.), and the mining bee (*Megachile* spp.), shows that almost without exception they are either hiber-

nating or so depleted in numbers during the blooming season of deciduous fruit that they are of little value as cross-pollinators. Records of flights at hive entrances show the activity of the honeybee to be closely coordinated with the temperatures at which fruit trees bloom.

Observations of the Pajaroella tick (*Ornithodoros coriaceus* Koch) by W. B. Herms and L. K. Wilson indicate that under field conditions oviposition takes place during June and July in the deer beds among the low scrub oak on Mount Hamilton.

A brief reference is made to investigations of the protection of piling against marine borers.

Further experimental work with the peach-twigg borer, by G. J. Gerson and R. E. Stanton, showed that the addition of arsenate of lead to lime-sulfur spray greatly increases its efficiency. Arsenate of lead was superior to lime sulfur in controlling the pest, while nicotine sulfate did not give as high control as during the two previous seasons.

Records kept by the horticultural commissioners have clearly shown that fumigation is far superior to spraying for control of citrus scale insects, though where the infestation is light citricola scale can be held in check by spraying with lime sulfur and miscible oil or with lime sulfur alone. Control work with the citrus red spider in Los Angeles county has shown 2 per cent lime sulfur with a spreader and the addition of from 5 to 10 lbs. of wettable or atomic sulfur to the 200-gal. tank to be the best control for inland districts.

Investigations of injury to the common Himalaya blackberry in Santa Cruz County, where growers have suffered losses ranging from 25 to 50 per cent of the crop due to its failure to mature, have shown this to be due to a blister mite. Complete control was obtained by the use of a spray of 4 per cent lime sulfur and 2 per cent Blackleaf 40 during the dormant season, followed by a 1 per cent lime sulfur applied when the buds began to curl.

In Alameda County the farm adviser obtained from 50 to 100 per cent control of the peach root borer by the use of paradichlorobenzene.

A stilt-bug, *Jalysus spinosus* Say, destructive to the tomato, C. R. PHIPPS (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 390-393, pl. 1).—The author reports the blighting of tomato blossoms in and about Mountain Grove and other parts of Missouri by *J. spinosus*, with a consequent failure in the set of fruit. Thorough applications of nicotine sulfate and Bordeaux mixture are effective in killing the nymphs and protecting the foliage from subsequent attack by adults. Two applications, the first as soon as migration to the tomato is noticed and the second early in August when the majority of the first brood nymphs are present, should give effective control.

Natural enemies of beet leafhopper (*Eutettix tenella* Baker), H. H. P. SEVERIN (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 369-377).—In reporting upon work at the California Experiment Station, the author records observations of a large number of predacious and parasitic insects that prey upon the nymphs and adults of the beet leafhopper in California, including seven species of egg parasites, two species of pipunculid flies, a dryinid, and a hair-worm. The percentage of parasitized larvae is said to increase gradually during the summer months, reaching its height during August (35.1 per cent).

Calcium cyanide dust for rosy apple aphid, C. C. WAGONER (*Jour. Econ. Ent.*, 17 (1924), No. 3, p. 417).—The application of calcium cyanide to 25-year-old Gravenstein and Baldwin apple trees at the rate of 3 lbs. per tree, by means of a Dosch hand duster, resulted in the destruction of a heavy infestation of winged and wingless forms of *Aphis sorbi*. Examinations of the trees during the season revealed no injury to either fruit or foliage as a result of

the application. The fruit averaged about 1 in. in diameter at the time the trees were dusted, and some of the infested leaves had already curled.

Lubricating-oil emulsion as a control for *Chrysomphalus aonidum* in greenhouses, C. A. WEIGEL and B. M. BROADBENT (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 386-389).—This is a report of experiments by the U. S. D. A. Bureau of Entomology, which show that one thorough application of a 1½ per cent lubricating oil emulsion gives satisfactory control of *C. aonidum* L. without injury to the plants.

The striped grass looper, *Mocis repanda* Fab., in Texas, R. A. VICKERY (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 401-406, pl. 1).—This is a report of studies by the U. S. D. A. Bureau of Entomology of an insect that has long been known as a serious pest of crops in tropical America and is occasionally injurious in southern Texas, having been observed at Brownsville injuring Bermuda grass and sugar cane in 1910 and destroying pasture grasses in 1916. In addition to corn, sugar cane, and Bermuda grass, the larvae fed on the following grasses: *Cenchrus viridis*, *Trichloris pluriflora*, *Eriochloa punctata*, *Leptochloa nealleyi*, and *Panicum fasciculatum*, the latter of which appeared to be the favorite host.

Certain wild grasses in relation to injury to corn by the "borer" (*Diatraea saccharalis* Fab.) in Louisiana, T. H. JONES and W. G. BRADLEY (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 393-395).—In studies at the Louisiana Experiment Stations, the authors find that the severe injury to corn which is often caused by the sugar cane borer is due to moths that fly to it in the spring from several wild grasses in which they develop.

The spotted cutworm, *Agrotis c-nigrum* (L.), a cranberry pest, H. J. FRANKLIN and D. S. LACROIX (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 406-408).—This is a contribution from the Massachusetts Experiment Station, in which the authors record outbreaks of *A. c-nigrum* on several cranberry bogs in southeastern Massachusetts during the summer of 1923. This insect is said to be the fourth species of cutworm now known to infest cranberry bogs seriously as a result of holding the winter flood very late, the others being the army worm, the fall army worm, and the black cutworm.

A method for the extermination of the round-headed apple-tree borer, O. A. JOHANSEN (*Jour. Econ. Ent.*, 17 (1924), No. 3, pp. 383-386).—The author finds fumigation with carbon disulfide to prove very successful as a substitute for the digging-out process in combating the roundheaded apple-tree borer. Within a cell of plastic clay or mud built against the tree, with the open side over the borer holes, a teaspoonful of carbon disulfide is poured, and the cell closed with a plug of clay. The surface of the cell is then wetted and smoothed down and carefully sealed to the tree and the earth. The author finds that this method gives 100 per cent control when properly done, requires less time than the digging-out process, and neither mutilates nor injures the tree.

The elm leaf beetle, R. H. PETTIT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 20, 21, fig. 1).—A brief account is given of the elm leaf-beetle, which has appeared in Michigan for the first time, having become established in the city of Monroe.

The tobacco flea-beetle in the dark fire-cured tobacco district of Kentucky and Tennessee, A. C. MORGAN and J. U. GILMORE (*U. S. Dept. Agr., Farmers' Bul.* 1425 (1924), pp. II+12, figs. 11).—This is a practical account of the flea-beetle and means for its control in the dark fire-cured tobacco district of Kentucky and Tennessee. It supplements the account of its control in the southern cigar-wrapper district previously noted (*E. S. R.*, 50, p. 56).

Selective parasitism by *Tiphia* sp., H. A. JAYNES and T. R. GARDNER (*Jour. Econ. Ent.* 17, (1924), No. 3, pp. 366-369).—The authors report that larvae of *Ochrosidia* (*Cyclocephala*) *immaculata*, which during the past several years have become very numerous on a golf course in the vicinity of Moorestown, N. J., were reduced approximately 93 per cent by a native species of fossorial wasp of the genus *Tiphia*. In the same manner the parasite increased in numbers, but as the abundance of the host was reduced, the numbers of the parasite decreased nearly 95 per cent, and, at the same time, the Japanese beetle became very numerous in the same locality. Investigations conducted indicate that the female *Tiphia* deposits her eggs by preference on the *Ochrosidia* rather than on *Popillia* larvae. Since it is possible for some individuals of *Tiphia* to develop successfully on *Popillia* grubs, it is thought possible that the *Tiphia* sp. may develop a strain which will become parasitic on this introduced pest.

FOODS—HUMAN NUTRITION

Nutrition laboratory, F. G. BENEDICT (*Carnegie Inst. Wash. Yearbook* 22 (1923), pp. 219-227).—The annual report contains, as in previous years (E. S. R., 49, p. 256), a brief outline of investigations in progress and a list, with brief abstracts, of the publications of the laboratory during the past year.

How to reduce the meat bill, P. E. LIGHT and J. C. STUART (*Canada Dept. Agr. Pamphlet* 43, n. ser. (1924), pp. 10, figs. 7).—This pamphlet has been prepared to help the housewife reduce the family meat bill through the selection and proper preparation of cheaper cuts of beef. A brief description, with chart, is given of the various beef cuts and their most suitable uses, followed by selected recipes.

Copper content of apricots (*California Sta. Rpt.* 1923, p. 160).—Apricots which had been sprayed with Bordeaux mixture a short time before picking were found to have a copper content of 1.08 parts per million, an amount less than that normally found in oysters and in many food materials of plant origin. It is concluded that no injurious results would follow the consumption of such apricots.

Effect of calcium chloride on acid-sugar-pectin gels, E. G. HALLIDAY and G. R. BAILEY (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 595-597).—To determine the effect of calcium ions on the pectin, sugar, and acid requirement for jellying, a standard jelly was made with the particular pectin and citric acid selected for the whole experiment. Having ascertained the sugar requirement for 1 per cent of pectin and 1 per cent of citric acid, the percentage of each of the ingredients was lowered successively with the addition of varying amounts of calcium chloride until the minimum jellying point was secured.

It was found that the amounts of all three substances were lowered by the presence of calcium chloride in amounts of from 0.5 to 1 per cent. The proportions of the various materials in the standard jelly were pectin 1, citric acid 1, and sugar 50 per cent. It was found possible to lower the sugar to 46, the citric acid to 0.3, and the pectin to 0.5 per cent (each of the other constituents being kept at the original concentration), and still obtain good jellies.

Two theories are advanced to explain the action of calcium chloride on jelly formation. One is that it forms a salt with the pectin, which has a greater tendency to gelatinize than does the original pectin, and the other that it increases the H-ion concentration of the solution by lowering the buffer action of the pectin.

Thermal process time for canned food, C. O. BALL (*Bul. Natl. Research Council*, 7 (1923), No. 37, pp. 76, figs. 24).—This publication, which is designed

for the use of the commercial rather than the home canner, consists of the derivation of a formula for obtaining the necessary length of process of a can of food under ideal conditions, the application of the formula to various relationships, and the deviations from the simple theoretical results. The value of the method described is said to be not so much for the direct calculation of the absolute length of the process to satisfy any given set of conditions as for the comparison of the relative merits of different combinations of factors influencing the process of sterilizing canned foods.

Continuation and extension of work on vegetable proteins, T. B. OSBORNE and L. B. MENDEL (*Carnegie Inst. Wash. Yearbook* 22 (1923), pp. 340-346).—The various studies noted in this progress report (E. S. R., 49, p. 360) have been noted previously from other sources.

Metabolic experiments on rats and digestibility of the proteins of some foodstuffs, B. C. P. JANSEN and W. F. DONATH (*Meded. Burgerl. Geneesk. Dienst Nederland. Indie No. 1* (1924), pp. 24-45, pl. 1, fig. 1).—A series of metabolism experiments conducted on rats to determine the digestibility of the proteins of some foodstuffs in common use in the Dutch East Indies is reported, together with a description of a metabolism cage devised by the authors.

The essential feature of this cage is the arrangement for collecting separately the feces and urine. The large mesh wire cage is supported at a considerable height above the laboratory table and fitted below with a sloping chute which was made first of narrow mesh brass netting, but later was replaced by nitrogen-free filter paper soaked in a solution of oxalic acid and dried. The feces roll down the chute into a porcelain dish, and the urine is absorbed by the filter paper. Any urine which fails to be absorbed drops into a dish below, where it is caught on filter paper soaked in sodium picrate to serve as an indicator.

The digestibility of the protein of the various foods tested was calculated in two ways— $\frac{N\text{-urine}}{N\text{-food}} \times 100$ or digestive factor A, and $\frac{N\text{-food}-N\text{-feces}}{N\text{-food}} \times 100$ or digestive factor B. In general, daily determinations were made for from 8 to 14 days. In the tests with rice, the rice was used as the sole food, and in the tests with soy beans and chayote leaves these were fed with cassava meal and coconut oil. The digestive factors A and B and the nitrogen balance in milligrams for the different foods tested are, respectively, as follows: Unpolished rice (nitrogen content 1.2 per cent) 60.2, 63.2, and +9.2; polished rice (nitrogen content 1.05 per cent) 72.7, 70.3, and -4.7; polished rice to which bran extract had been added (nitrogen content of the mixture 1.2 per cent) 73.5, 66.3, and -16.5; polished rice (nitrogen content 1.05 per cent) 73.6, 77.3, and +17; half-polished rice 100 years old (nitrogen content 1.27 per cent) 78.1, 78.7, and -19.8; polished rice (nitrogen content 1.19 per cent) 83.7, 84, and +3.8; soy bean (nitrogen content of the mixture 3.79 per cent) 73.3, 76.4, and +58.8; and chayote leaves (nitrogen content of the mixture 2.65 per cent) 66.4, 67.1, and +83.

For comparison with the rat experiments, three metabolism experiments were conducted on human subjects, using rice as the chief source of nitrogen. In the experiment in which half-polished rice with a nitrogen content of 1.3 per cent was used, the values for digestive factors A and B were 67 and 64.5 per cent, with a nitrogen balance of 0.43 mg. Corresponding values for unpolished rice with a nitrogen content of 1.2 per cent were 54.7, 47, and +1.04 and for the half-polished rice 100 years old 65, 65, and +0.08.

The stimulating action of food on intermediary metabolism, I [trans. title], W. LAUFBERGER and J. A. ŠEŤČÍK (*Biochem. Ztschr.*, 145 (1924), No. 3-4, pp. 274-278).—The method employed in this study of the effect of the oral administration of certain foods on the intermediary metabolism of rabbits was to take a sample of the rabbit's blood, administer through a stomach tube a solution of the sample being tested, and at 5-minute intervals thereafter for an hour take other samples of blood and examine them for sugar by the Bang method. The rabbits had previously fasted for 24 hours.

Olive oil had no effect on the curve of blood sugar, but peptone or egg albumin produced within the first 5 minutes a hyperglycemia of varying duration.

What to feed the children, D. R. MENDENHALL (*Wis. Agr. Col. Ext. Circ.* 166 (1924), pp. 24, fig. 1).—This circular on the feeding of infants and young children discusses the number of feedings a day at different periods up to 18 months, artificial feeding during the first year, and food for the second, third, and fourth to tenth years, with general suggestions on the child's diet and standards of nutrition.

A table, compiled from data on Wisconsin school children, is given of the average stature for a given age and the average weight without clothes for a given stature of boys and girls up to the age of 18 years. Other tables include the average weight of infants for the first 12 months after birth, lists of food rich in calcium and in iron, and the relative amounts of vitamins and protein in investigated foods used for children.

Vitamins, I, II [trans. title] (*Biochem. Ztschr.*, 139 (1923), No. 1-3, pp. 47-65, figs. 5).—Two papers are presented.

I. *The vitamin content of honey*, A. Scheunert, M. Schieblich, and E. Schwanebeck.—Three samples of honey were tested for the presence of vitamins A, B, and C by appropriate feeding experiments in which 3 gm. of the honey served as the sole source of the vitamin in question. As judged by the limited amount of evidence (three rats being used for each test), none of the samples contained any of the three vitamins.

II. *The synthesis of vitamin B by obligate intestinal bacteria*, A. Scheunert and M. Schieblich.—In this further study of the possible synthesis of vitamin B by intestinal bacteria (*E. S. R.*, 48, p. 363), *Bacillus vulgatus*, an organism found in the intestines of Herbivora, was grown on a synthetic vitamin-free medium and fed in the dried state as the sole source of vitamin B to pigeons in a state of nutritive decline on a vitamin-free diet. The prompt increase in body weight and elevation of temperature to normal are thought to indicate that *B. vulgatus* has the property of synthesizing vitamin B.

The A-vitamin-content of different Indian foodstuffs and the value of the proteins of these latter as a supplement to the proteins of rice, B. C. P. JANSEN and W. F. DONATH (*Meded. Bergerl. Geneesk. Dienst Nederland. Indie* No. 1 (1924), pp. 46-98, figs. 19).—In this investigation, foods in common use in the East Indies were tested for their value as sources of proteins and vitamin A by being fed to rats as supplements to a diet of polished rice. In general the curative method was used, i. e., the food to be tested was not added to the ration until the animals had ceased growing and in many cases had developed xerophthalmia. To determine whether failure to grow was due to protein or vitamin deficiency, cod liver oil was added to all diets on which growth had ceased.

From the results reported, a classification of the various foodstuffs with respect to vitamin A has been made along the lines noted in a study of vitamin B (*E. S. R.*, 51, p. 370). (1) Foodstuffs very rich in vitamin A, of which

the addition of from 1 to 5 per cent on the dry basis is sufficient to supplement satisfactorily a vitamin A-free basal diet. Among the food materials placed in this group, with the estimated amounts for curing xerophthalmia, are the following fruits: Banana 0.5 gm., sapodilla 1, papaya 1, and avocado from 0.5 to 1 gm. The vegetables included in this group are cowpeas (dried and powdered) 3 per cent, leaves of cowpeas dried 3, cassava leaves (boiled and dried) 5, pumpkin leaves (boiled and dried) 1, fresh pumpkin from 1 to 2, boiled and dried pumpkin 5 per cent, chayote fruit or leaves (boiled and dried) 5, and fresh cucumber from 5 to 10 gm. Animal products in this group include ducks' eggs (dried and sealed) 3 per cent, butter preserved in tins 5, and cod liver oil 0.5 per cent.

(2) Foodstuffs having so little vitamin A as to be insufficient to prevent the symptoms of vitamin A deficiency when used exclusively. In this group are placed rice (polished and unpolished), corn (at least the white variety), coconut press cake, and peanut press cake. (3) Food materials which do not furnish sufficient vitamin A when fed at a level of from 5 to 10 per cent, but might prove sufficient if given in larger amounts. In this group are placed meat, soy beans, dried fish and shrimps, and palm oil.

Definite conclusions are not drawn concerning the protein values of the foods tested, although it is considered that the proteins of soy beans are of greater value than those of meat or dried fish.

Materials recommended as best fitted to supplement the deficiencies of rice in vitamin A are bananas, fresh or boiled vegetables, and ducks' eggs. It is estimated that the use of one banana daily is sufficient to prevent symptoms of vitamin A deficiency on a diet consisting chiefly of rice.

Comparative tests on the respiratory capacity of various tissues and their content of vitamin B [trans. title], K. ROHR (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 129 (1923), No. 4-6, pp. 248-267, figs. 2).—As a confirmation of the theory of Hess that vitamin B deficiency lowers the oxidative processes of the body tissues (*E. S. R.*, 47, p. 862), the author reports a comparative study of the respiratory activity, as measured by the capacity to reduce *m*-dinitrobenzol of various organs of guinea pigs and the ability of these organs to cure polyneuritis in pigeons.

The guinea pig organs showed decreasing respiratory activity in the order of kidney, liver, brain, and muscle. The kidney proved much more effective than the other organs tested in relieving the symptoms of polyneuritis, with liver next, and brain and muscle of about the same value. It is concluded that any tissue which in vitro shows high oxidative capacity will prove active as an antineuritic agent.

The effect of heat on the reducing properties of dried yeast and its vitamin value, with a discussion of pigeon beriberi [trans. title], W. R. HESS and K. ROHR (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 129 (1923), No. 4-6, pp. 268-283, figs. 2).—This paper consists of a general discussion of the symptoms noted in the polyneuritic pigeons of the above study and the report of a comparison of the effect of heat treatment at different temperatures on the reducing power of yeast suspensions and their ability to cure polyneuritis.

It was found that temperatures as low as 40° C. decreased the reducing power of yeast, but at none of the temperatures tested, which did not exceed 100°, was there any loss of antineuritic properties.

Vitamin investigations (*California Sta. Rpt.* 1923, p. 164, fig. 1).—It is reported that preliminary results indicate that pasteurized strawberry sirup is superior to either loganberry or blackberry sirup as a source of vitamin C.

The influence of diet and management of the cow upon the deposition of calcium in rats receiving a daily ration of the milk in their diet, M. A. Boas and H. CHICK (*Biochem. Jour.*, 18 (1924), No. 2, pp. 433-447, figs. 3).—In the investigation reported, the method described in the paper previously noted (*E. S. R.*, 51, p. 806) was used to follow the retention of calcium and phosphorus in young rats on a diet complete in every respect except for fat-soluble vitamins, the only source of these being 5 cc. daily of milk from the same cow under different conditions of feeding: (1) After 6 months on a diet of dry fodder in a dark stall, (2) after two months on a diet of green food in a dark stall, and (3) after two months on pasture in summer. The composition of the three samples of milk with respect to fat, calcium, and phosphorus was as follows: Fat 3.85, 3.9, and 5.1; calcium 0.12, 0.114, and 0.122; and phosphorus 0.101, 0.079, and 0.082 per cent, respectively.

A single metabolism experiment involving 4 young rats, 2 of each sex, was conducted for each sample, each series being provided with the same number of controls on the basal diet supplemented by 5 cc. of a reconstituted standard dried milk supplemented with three drops (0.073 gm.) of cod liver oil daily. The rats had not been on a vitamin A-deficient diet previous to the experiment and continued to grow without interruption during the six weeks of the experiments.

"Rats receiving samples (1) and (2) showed defective calcium retention as compared with control rats on the same basal diet supplemented with cod liver oil and an equivalent ration of dried milk. The retention of phosphorus was also affected, but to a less degree. In these animals the ratio of calcium retained to phosphorus retained was found to decrease steadily during the early weeks of life, whereas in normal animals this ratio shows a steady increase.

"Rats receiving sample (3) showed no significant difference in calcium retention as compared with the control animals. Complete analyses of the bodies of these rats, aged 11 to 12 weeks, were made to show the distribution of calcium and phosphorus and the ratio of these substances to one another in the skeleton and soft tissues. The results obtained were practically identical for animals of both series.

"The influence of cod liver oil upon calcium deposition is not to be attributed to specific properties peculiar to that substance but to its high content of fat-soluble vitamins, as a similar effect upon calcium deposition can be demonstrated in the case of cow's milk, the degree depending on the diet of the cow and the amount of sunlight to which she is exposed."

Contribution to the nitrogen and mineral metabolism in avitaminosis [trans. title], N. HIRABAYASHI (*Biochem. Ztschr.*, 145 (1924), No. 1-2, pp. 18-31, fig. 1).—Nitrogen, phosphorus, calcium, and magnesium metabolism experiments are reported on a full-grown dog during a foreperiod of 6 days on a vitamin-rich diet and a main period on a vitamin-free diet continuing until the death of the animal on the one hundred and eighth day. The main period was further divided into two periods, the first, which lasted until the forty-third day, being considered as the period of true avitaminosis uncomplicated by starvation, and the remainder the period of avitaminosis complicated by starvation through failure of the appetite.

In the foreperiod there was a slight gain in weight and a slight positive nitrogen balance. In the first part of the main period the weight fell very slightly during the first 18 days, then increased up to the forty-second day, after which, with the onset of gastric disturbances, it again fell rapidly. In

the remaining period the curves of loss in weight and nitrogen balance ran parallel, with occasional exceptions.

In the foreperiod the phosphorus, calcium, and magnesium balances were negative. In the first part of the vitamin-free period these became more strongly negative and later slightly positive. Shortly before the nitrogen elimination increased, the phosphorus, calcium, and magnesium balances again became strongly negative. In general the mineral metabolism followed that of the protein.

Experiments on nitrogen metabolism in avitaminosis [trans. title], J. A. COLLAZO (*Biochem. Ztschr.*, 145 (1924), No. 5-6, pp. 436-441).—A brief report, with experimental data, is given of nitrogen metabolism experiments conducted on three dogs maintained for some time on a vitamin-free ration.

During the course of avitaminosis, the purine nitrogen of the urine increased slightly until shortly before death, when it sank to the original level. The values for uric acid showed similar changes on long continued avitaminosis. The allantoin content of the urine fluctuated, with a tendency to somewhat higher values than normal until shortly before death, when there was a decrease. The values for uric acid and allantoin sometimes ran parallel and sometimes not. The ammonia and amino acid content of the urine increased gradually, and that of urea decreased. Normal values for phosphoric acid were obtained in the early stages, but with the decrease in body weight there was a tendency to higher values.

In the blood the residual nitrogen showed a slight increase, the urea remained unaltered for a short period but showed a tendency to increase later, and the amino acid increased steadily, especially in the later stages of the disease.

These results are considered to confirm those Adachi (*E. S. R.*, 51, p. 463) and Alpern (*E. S. R.*, 50, p. 565).

The effect of a one-sided diet on avitaminosis and the behavior of the body temperature in this condition [trans. title], K. ASADA (*Biochem. Ztschr.*, 139 (1923), No. 1-3, pp. 234-252, fig. 1).—To determine whether vitamin deficiency renders the animal particularly sensitive to a one-sided diet, three groups of 5 rats each were fed a basal diet consisting of an adequate salt mixture and sufficient protein for maintenance. The diet of all the animals in the first group was supplemented with vitamins, in the second was vitamin-free, and in the third was vitamin-free for a preliminary period of 4 weeks. One animal in each group received sufficient protein, fat, and carbohydrate to make the diet adequate, and the other 4 protein, fat, sugar, and starch, respectively, ad libitum.

Among the animals receiving a diet containing vitamins, those receiving protein as the only supplement died in the third or fourth week, and those on starch in the eighth or ninth week, while those on sugar and fat lived throughout the experimental period of 10 weeks. The protein-fed animals lost weight rapidly, those on starch gained and then lost, and those on sugar and fat remained at constant weight. The survival period of the rats on the diets containing no vitamins was much shorter than on the vitamin-containing diet. The most rapid loss in weight occurred on the protein diet, followed by fat, sugar, and starch.

Can ultraviolet light hinder the development of hypochromatic anemia in avitaminous animals? [trans. title] P. M. SUSKI (*Biochem. Ztschr.*, 130 (1923), No. 1-3, pp. 258-260).—Data are reported on the number of red blood cells, percentage of hemoglobin, and color index of the blood of four pigeons fed polished rice, (1) three weeks after the feeding of polished rice, (2)

the same pigeons after a 15-minute treatment for 6 days with ultraviolet light, (3) the same after the seventh treatment, and (4) 24 hours after the seventh treatment. The numbers of red blood cells of the four groups were 3,991,000, 4,190,300, 3,962,000, and 4,123,000. These results are thought to indicate that ultraviolet light checks the progress of anemia resulting from vitamin deficiency.

Does the administration of salt hasten the appearance of nerve disturbances in avitaminous animals? [trans. title] P. M. SUSKI (*Biochem. Ztschr.*, 139 (1923), No. 1-3, pp. 253-257).—The intravenous or intramuscular injection of sodium, potassium, and calcium chlorides into pigeons fed polished rice was found not to hasten the appearance of the characteristic symptoms of polyneuritis.

Experimental researches relative to the mechanism of the production of the symptoms characteristic of a disease of unbalanced nutrition, avian polyneuritis [trans. title], L. RANDOIN and H. SIMONNET (*Bul. Soc. Sci. Hyg. Aliment.*, 12 (1924), No. 2, pp. 86-112, figs. 11).—This is a detailed report of extensive studies conducted by the authors on the nutritive requirements of the pigeon leading to the adoption of the artificial diet described in a previous communication (*E. S. R.*, 51, p. 70).

Pathogenesis of deficiency disease.—XVII, **The relation of faulty nutrition to the development of epithelioma contagiosum**, R. McCARRISON (*Indian Jour. Med. Research*, 11 (1924), No. 4, pp. 1119-1130, pls. 3).—Previously noted from another source (*E. S. R.*, 49, p. 885).

Inverse relation between iodine in food and drink and goiter, simple and exophthalmic, J. F. McCLENDON and J. C. HATHAWAY (*Jour. Amer. Med. Assoc.*, 82 (1924), No. 21, pp. 1668-1672, figs. 4).—Data are reported on the iodine content of foods of vegetable and animal origin and of drinking water from various sources in goitrous and nongoitrous regions of the United States. A comparison of the reported figures with the distribution of goiter shows a consistently lower iodine content in the foods and water of goitrous regions. The highest content of iodine reported was 18,470 times as great as the lowest. This is thought to answer the objections that have been advanced to putting minute traces of iodine in drinking water to prevent goiter.

ANIMAL PRODUCTION

A study of ensiling a mixture of Sudan grass with a legume, P. A. WRIGHT and R. H. SHAW (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 3, pp. 255-259).—This paper deals with a study conducted at the Dairy Division, U. S. D. A., dealing with the advantages, if any, of mixing low protein and high carbohydrate crops with others high in protein and low in carbohydrates for the production of silage. Five experimental silos were filled on September 2 with the following silage crops: Fresh Sudan grass, wilted soybeans, wilted cowpeas, and mixtures of equal parts of soybeans and Sudan grass and wilted cowpeas and Sudan grass. The Sudan grass was cut at the dough stage, while the soybeans and cowpeas were well podded at the time of ensiling. The materials were well packed in the experimental silos and weighted. At the time of opening on December 3 all the silages were in good condition except the Sudan grass, a part of which was moldy. The following table gives the chemical composition of the five types of silage at the time of ensiling and at the time of opening the silos:

Composition of silages as put into and taken out of silos

Kind of silage	Dry matter in moist material		Water-free basis												Ash	
			Total protein		Albumi-noid pro-tein		Crude fiber		Ether extract		Nitro-gen-free extract					
	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out		
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	
Sudan grass alone.....	30.3	28.9	6.0	6.4	5.3	4.5	34.0	35.2	1.5	1.9	53.0	50.4	5.5	6.1		
Sudan grass and soybeans.....	30.3	30.1	11.0	11.3	9.0	7.1	31.6	34.0	1.4	2.3	49.3	44.9	6.8	7.5		
Soybeans alone.....	36.3	34.8	16.7	17.6	12.7	9.8	30.5	32.7	1.2	2.0	44.9	39.5	6.7	8.3		
Cowpeas alone.....	31.8	31.0	16.0	15.9	13.4	9.9	23.8	27.1	1.5	2.6	51.0	45.6	7.7	8.8		
Sudan grass and cowpeas.....	33.3	30.6	11.8	12.3	9.8	8.9	29.9	30.6	1.7	2.5	49.6	46.6	7.1	8.1		

In tests with dairy cows of the palatability of the different silages which were of very short duration, the Sudan grass silage was decidedly the least palatable, while the soybean silage was most palatable, though it was closely followed in palatability by cowpea silage and both of the mixtures, which were considered of equal value.

It is concluded from the study that it is not necessary to mix high protein and high carbohydrate crops for the production of good silage, as the crops containing the larger amounts of carbohydrates usually take care of themselves, while the wilting of high protein crops will make them satisfactory for the production of a good type of silage.

Acidity in relation to quality in sunflower silage, M. J. BLISH (Montana Sta. Bul. 163 (1924), pp. 13).—This is a continuation of the studies of the quality of sunflower silage previously noted from this station (E. S. R., 45, pp. 871). The H-ion concentration, volatile and nonvolatile acidity and the ratio between them in the silage juice, and the content of reducing sugars and sucrose in the dry matter of the fresh plant, as well as the quality of the silage produced in each case, are tabulated for samples of corn, sunflower, and mixtures of corn and sunflowers ensiled in large silos, 2-qt. jars, and 100-lb. cans.

Due to the large amounts of water present in green sunflower silage, considerable juice is pressed out which contains much of the acid-forming materials and thus further reduces the already low sugar content of sunflower silage. This favors the development of butyric acid-forming bacteria and accounts for the customary spoilage in the center of the silo. The material lower in the silo may, however, keep, due to the washing down of the acid-forming materials from above. Butyric acid bacteria can apparently develop only when the H-ion concentration is below 4.9. The addition of sugars or mixing of sugar-containing materials as corn, molasses, etc., with sunflower silage was found to favor better fermentation with the production of a higher acidity and the prevention of spoilage. Irrigation was found to be a contributing factor toward a low sugar content of the sunflowers.

The poorer qualities of silage seemed to be associated with a high ratio of volatile to nonvolatile acid. Although the total acidity of two silages may be the same, the quality may be very different, due to the relative amounts of acetic and lactic acid present.

The use of 2-qt. fruit jars kept in the laboratory for studying the changes during the ensiling process was found more satisfactory than 100-lb. tins left

in the cold, as the action in the former containers more closely approximated that occurring in large silos. Due to the lack of pressure, the silage in both cases was more moist than is found in silos. Valves allowing the escape of gases without the entrance of air were attached to the fruit jars.

Schweizer electrical and Italian methods of green forage preservation (*California Sta. Rpt. 1923, pp. 50, 89*).—In continuing the study of the electrical method of green forage preservation (E. S. R., 48, p. 568), corn and honey sorghum silage were prepared by A. H. Hoffman in jars 2.5 ft. in diameter and 4 ft. high and treated with an electric current. It required 27.5 and 32.4 kw. hours per ton of the respective silages to raise the temperature to the required 122° F. The difference in the electrical requirements was probably due to the initial temperature at the time of ensiling. When the silos were opened in May, after filling in October, a large amount of spoiled silage was found at the top of each jar. The remaining silage in both cases was very palatable to animals.

A third experimental jar was filled with wilted corn and sealed (Italian method). This silage was practically all in good condition and palatable when fed to dairy cows. It is concluded that the Italian method is comparatively practical and economical, while the cost of the Schweizer electrical method practically prohibits its use.

[Composition of livestock feeds] (*California Sta. Rpt. 1923, pp. 160, 161, 162, 163, 164, 165*).—The analyses of various plants having more or less possible value as feeds for livestock, including Carob bean and Giant kale stalks, are discussed.

Alfalfa hay.—The following analyses of first, second, third, and fourth cuttings of alfalfa hay were made: Moisture 9.47, 8.99, 8.86, and 8.67 per cent; protein 16.96, 13.43, 17.69, and 17.29 per cent; fat 1.83, 2.16, 3.26, and 2.33 per cent; nitrogen-free extract 34.77, 35.81, 36.84, and 38.01 per cent; crude fiber 26.49, 31.62, 23.15, and 24.13 per cent; and ash 10.48, 7.99, 10.20, and 9.57 per cent, respectively.

Cherokee rose.—A sample of the leaves and stems of the Cherokee rose has been analyzed, from which it is concluded that the plant is richer in protein than either wheat or oat hay on the same moisture basis, and the crude fiber content is less than that reported for ordinary cereal hays. This sample contained 23.4 per cent of moisture.

Horse bean.—A physical analysis of several plantings of horse beans has indicated that the sample planted in February contained 35.9 per cent leaf, while the sample planted in December contained 38.29 per cent pod. The analysis of this plant proves it to be a valuable feed which is richer in protein than the cereal fodders on the same moisture basis and compares favorably with alfalfa.

Malva leaves as green food for poultry.—The analysis of malva leaves has shown them to contain the following percentages of nutrients: Moisture 80.9, protein 8.34, fat 0.86, nitrogen-free extract 6.09, crude fiber 1.38, and ash 2.43 per cent. The high ash content of this material would indicate that the malva is an excellent green food for poultry.

Orange by-products as cattle food.—Samples of orange pulp suitable for stock feed were received in a sound condition, having a pleasant odor and being very palatable. Its composition compared favorably with beet pulp silage, but contained less crude fiber and about 50 per cent more minerals, as well as vitamins. Should orange pulp and orange pulp silage be relished by cattle, they should prove of higher value than the beet by-products.

Analyses of range forage plants collected at Shingle Springs.—The protein content of samples of range forage plants collected at Shingle Springs has been found to be low, which is probably due to the fact that these samples were practically devoid of seeds. The maximum crude fiber content agrees fairly well with that of rye hay, while the minimum agrees with that of alfalfa hay.

Vicia monanthos seed, flowered vetch or lentil as a supplemental feed for cattle.—An analysis of the seeds of the flowered vetch or lentil (*V. monanthos*) shows that it corresponds almost identically with the ordinary lentil and is richer in protein than coconut oil cake meal.

Watermelon pulp and rind as supplemental feed for livestock.—Analyses of dried watermelons have indicated that this product contains about 13 per cent of protein. The content of fat and mineral matter is also higher than that usually reported for grain, but the crude fiber is also fully 10 times as great as that reported for wheat or corn.

Whale meat and bone for feeding poultry.—An analysis of the sample of whale meat and bone has shown that this product contains about 39.4 per cent of crude protein and 43.15 per cent of ash, consisting mainly of calcium phosphate. Only a small percentage of fat was found in the material analyzed. Whale meat similar to this sample should furnish a desirable source of protein for poultry feeding, as well as furnishing required minerals.

Composition of official samples of feeding-stuffs and mixtures collected in New York from January to July, 1923, L. L. VAN SLYKE (New York State Sta. Bul. 515 (1924), pp. 3-18).—The results of a study of the composition of the 1,100 samples of feeding stuffs and mixtures officially analyzed during the first six months of 1923 are reported. The high, low, and average guarantees and analyses of each feeding material and the range for the mixtures, as well as the number of mixtures containing different feeds are tabulated. The numbers of deficiencies are also noted in each case.

Mineral feeding investigations, O. E. REED and C. F. HUFFMAN (Michigan Sta. Quart. Bul., 7 (1924), No. 1, pp. 14-16).—A popular discussion is given of the mineral requirements of livestock and more especially dairy animals, as well as the rations planned to be used in an experiment with heifers to compare roughages as sources of minerals.

[Beef cattle feeding experiments at the University of California] (California Sta. Rpt. 1923, pp. 75, 76, fig. 1).—The results of feeding experiments with beef cattle, most of which are continuations of those previously noted (E. S. R., 48, p. 569), are reported.

Feeding trials with calves.—Thirty-four calves brought from the range on November 26 made average daily gains of 2.12 lbs. during December on alfalfa pasture, 0.29 lb. during January on poor volunteer pasture, 0.46 and 0.56 lb., respectively, during February and March on fairly good volunteer pasture, and 1.74, 2.83, and 2.25 lbs., respectively, during April, May, and June on alfalfa pasture. Injury to the alfalfa by grasshoppers reduced the July gains to 0.43 lb. per day.

Feeding trials with steers v. heifers.—One lot of steers made average daily gains of 2.19 lbs. from July 28 to October 27, while a similar lot of heifers made average daily gains during the same period of 2.26 lbs. At the end of the trial, the steers, however, were sold for \$2 per hundredweight more than the heifers.

Two-year-old steers v. yearlings.—A lot of yearlings made average daily gains of 2.3 lbs. during a 120-day feeding test on a ration of barley, cottonseed

meal, alfalfa hay, and sorghum silage, while a comparative lot of 2-year-olds made average daily gains of 1.86 lbs. on the same ration. The yearlings consumed an average of 44.47 lbs. of feed per day, while the 2-year-olds consumed 51.65 lbs. of feed daily. The steers of both ages brought the same price at selling.

Finishing baby beef, G. A. BROWN and G. A. BRANAMAN (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 3-6, fig. 1).—The results of a comparative test of methods of feeding baby beef are reported. Three lots of 10 Hereford steer calves each averaging 463 lbs. in weight were selected. The basal ration fed to all lots consisted of alfalfa hay, silage, minerals, and a grain mixture composed during the first 60 days of equal parts of corn and whole oats, during the second 60 days of 3 parts of corn to 1 of whole oats, and during the last 70 days of corn only. Lots 1 and 2 received oil meal in amounts of 1 lb. per day during the first 120 days and 1.5 lbs. daily during the next 30 days, followed by 2 lbs. per day during the last 40 days. Lot 1 received the grain in a self-feeder after the first 30 days, lot 2 was hand-fed its grain twice daily, receiving about two-thirds as much as lot 1. Lot 3 received an amount of grain equal in weight to the grain and oil meal fed to lot 2. Four pigs followed the calves in lot 1 and 2 each in lots 2 and 3. These pigs required considerable extra feed. The results of the experiment are summarized in the following table:

Summary of baby beef production experiments

Lot	Average daily gain	Average daily ration					Calculated cost per 100 lbs. gain	Selling price
		Corn	Oats	Oil meal	Silage	Alfalfa		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
1-----	2.65	10.21	2.65	1.24	7.34	3.32	\$10.23	\$9.70
2-----	2.56	6.34	1.59	1.24	16.70	4.97	9.38	9.20
3-----	2.33	7.36	1.82	-----	11.46	5.36	9.20	9.20

Fattening beef calves, S. H. RAY, rev. by A. T. SEMPLE (*U. S. Dept. Agr., Farmers' Bul.* 1416 (1924), pp. II+13, figs. 7).—This is a popular account of the various phases of fattening calves for market, and supersedes Farmers' Bulletin 811 (E. S. R., 37, p. 367).

Feeding trial [with sheep at the California Station] (*California Sta. Rpt.* 1923, pp. 83, 84).—The 192 lambs used were divided into four lots for comparing the feeding value of various rations. The average daily rations, gains, and the calculated costs per 100 lbs. of gain on each ration were, respectively, lot 1 0.745 lb. of barley and 3.61 lbs. of bean straw, 0.193 lb., and \$11.94; lot 2 0.815 lb. of barley and 2.93 lbs. of cut alfalfa hay and cut barley straw, 0.197 lb., and \$14.26; lot 3 0.727 lb. of barley and 2.84 lbs. of cut alfalfa hay, 0.294 lb., and \$10.68; and lot 4 0.724 lb. of barley and 2.64 lbs. of whole alfalfa hay, 0.22 lb., and \$8.10.

Winter feeding of breeding ewes, W. E. JOSEPH (*Montana Sta. Bul.* 164 (1924), pp. 16, figs. 4).—This consists of summaries of experiments conducted from 1916 to 1921 in comparing various rations for wintering breeding ewes, the more essential results of which are mostly tabulated as follows:

Summary of comparative rations for breeding ewes

Ex- per- iment	Year	Lot	Num- ber per lot	Length of period	Average daily ration	Average initial weight	Aver- age gain	Average daily cost of feed per ewe ¹
				<i>Days</i>		<i>Lbs.</i>	<i>Lbs.</i>	<i>Cents</i>
1-----	1916-17	1	12	89	4.1 lbs. clover hay and 0.08 lb. oats.	165	12	1.72
		2	12	90	3.6 lbs. clover hay, 1 lb. beets, and 0.08 lb. oats.	166	15	1.72
		3	29	40	2.33 lbs. hay, 1.87 lbs. straw, 0.78 lb. beets, and 0.08 lb. oats.	175	-1	1.33
2-----	1917-18	1	15	69	4 lbs. hay and 0.17 lb. oats.	168	11	1.81
		2	15	69	3.07 lbs. hay, 2.08 lbs. sunflower silage, and 0.16 lb. oats.	165	12	1.73
		3	15	69	3.07 lbs. hay, 0.26 lb. cottonseed cake, and 0.16 lb. oats.	167	20	2.30
3-----	1919-20	1	14	62	4 lbs. alfalfa hay.	148	21	1.60
		2	14	62	3 lbs. alfalfa hay and 2.6 lbs. sunflower silage.	150	16	1.59
		3	14	62	3 lbs. alfalfa hay and 0.18 lb. linseed oil cake.	143	14	1.78
		4	8	62	1.6 lbs. alfalfa hay and 4.2 lbs. sunflower silage.	142	-7	1.27
4-----	1919-20	1	12	73	3.9 lbs. alfalfa hay.	140	21	1.57
		2	11	73	5.5 lbs. sunflower silage, 0.5 lb. oat straw, and 0.22 lb. cottonseed cake.	140	11	1.62
5-----	1920-21	1	15	75	4 lbs. alfalfa hay.	153	23	1.60
		2	15	75	2.8 lbs. alfalfa hay and 3.9 lbs. sunflower silage.	154	25	1.72
		3	15	73	2 lbs. alfalfa hay and 5.6 lbs. sunflower silage.	154	20	1.64

¹ Calculated on the basis of the following prices: Clover and alfalfa hay, oat straw, sunflower silage, and beets at \$8, \$2, \$3, and \$4 per ton, respectively; oats, cottonseed cake, and linseed oil cake at \$1.25, \$3.25, and \$3.25 per hundredweight, respectively.

Rations of 4 lbs. of alfalfa or clover hay per day were found to be very satisfactory for wintering breeding ewes. The substitution of beets for a portion of the hay at the rate of 1 lb. for each 0.5 lb. of hay gave equally good results. Sunflower silage was not satisfactory as the sole feed, and no advantages were shown for its use in replacing part of the hay. A ration without hay consisting of sunflower silage, oat straw, and cottonseed cake gave fairly good results. The replacement of hay by cottonseed cake or linseed oil cake added to the cost of the ration and showed no advantages. Supplementing the ration with from 0.25 to 0.5 lb. of oats for from 20 to 30 days before lambing is thought to insure strong lambs and a good milk flow.

[Comparative rations for fattening hogs] (*California Sta. Rpt. 1923*, pp. 85, 86, 87, 88).—The results of the following experiments are given:

Feeding rice and rice by-products to swine.—In continuing the comparative trials of rice and rice by-products (E. S. R., 48, p. 571), E. H. Hughes and B. H. Thomas fed 8 lots of 10 pigs each for 3 months on self-feeders in dry lot and compared the following rations: (1) Rolled barley and tankage, (2) brewers' rice and tankage, (3) rolled barley, rice polish, and rice bran mixed in equal parts, (4) rolled barley and rice polish mixed in equal parts, (5) rolled barley and rice bran mixed in equal parts, (6) rolled barley and rice polish mixed in equal parts, plus tankage in a separate self-feeder, (7) rolled barley and rice bran mixed in equal parts, plus tankage in a separate self-feeder, and (8) rice paddy and tankage mixed in the proportion of 9:1, cooked for 12 hours, and hand-fed twice daily. The results indicate that the lots not receiving tankage gained slowly and consumed large amounts of feed per

unit of gain. The most rapid and economical gains were made on the ration of brewers' rice and tankage. The pigs did not do well on the cooked rice ration.

Feeding paddy rice.—Six lots of 12 pigs each were used in comparing the feeding value of coarse and finely ground damaged and undamaged rice paddy when self-fed in dry lot. "The results of the test indicate that paddy rice and damaged paddy rice, when finely ground, can be successfully fed to fattening swine in the dry lot when supplemented with tankage."

Tannery waste feed experiment.—In a 94-day trial various rations were compared for fattening swine, using 6 lots of 5 pigs each, averaging 69.2 lbs. in weight. The results of the experiments indicated that the largest average daily gains, 1.34 lbs., were made on a ration in which 295.44 lbs. of rolled barley and 1,217.19 lbs. of skim milk were consumed per 100 lbs. of gain. The lowest average daily gains, 0.47 lb., were made on a ration in which 677.44 lbs. of rolled barley and 75.27 lbs. of tannery waste were consumed per 100 lbs. of gain. One lot receiving rolled barley only made average daily gains of 0.61 lb. as compared with 0.67 lb. by another lot receiving rolled barley and tannery waste mixed. The requirements per 100 lbs. of gain were in the first lot 571.92 lbs. of rolled barley and in the second lot 527.91 lbs. of rolled barley and 68.42 lbs. of tannery waste.

Yeast for fattening swine, G. A. BROWN and W. E. J. EDWARDS (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 7, 8).—The value of adding yeast to the ration of fattening pigs was investigated in a 90-day test with 3 lots of 88-lb. pigs. The basal feed mixture consisted of 100 lbs. of corn meal and 12 lbs. of tankage, the latter being reduced to 9.5 lbs. during the second 30 days and finally to 8 lbs. during the last 30-day period. The feeds were given as a slop to which 0.25 per cent of yeast was added 48 hours before feeding for lot 1, while 0.5 per cent of yeast was added to the slop just before feeding for lot 2. The lot receiving the fermented feed and no yeast made practically equal gains, requiring similar amounts of feed. The lot having the yeast added to its ration at feeding time did not make as good gains, though no reason for this is given.

Hogging off corn, G. A. BROWN and W. E. J. EDWARDS (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 6, 7).—The results are reported of a 33-day test in comparing the gains made by 3 lots of pigs averaging about 110 lbs. when receiving supplements of whole oats, soy beans, and tankage in addition to corn hogged off. The average daily gains made by the different lots receiving the various supplements were whole oats 1.25, soy beans 1.17, and tankage 1.79 lbs. The first lot required per 100 lbs. of gain 471 lbs. of corn and 52 lbs. of whole oats. The second lot required 513 lbs. of corn and 35 lbs. of soy beans, while the third lot required 412 lbs. of corn and 15 lbs. of tankage.

[Investigations with poultry at the California Station] (*California Sta. Rpt.* 1923, pp. 220-224, 225, 226, figs. 2).—Summaries of the experimental work with poultry, most of which was conducted by J. E. Dougherty and S. S. Gossman, are given. Many of the experiments are in continuation of those previously noted (*E. S. R.*, 48, p. 572).

Feeding value of different grades of meat scrap.—A lot of hens receiving additions to the basal mash of 15 per cent of a 40 to 45 per cent protein meat scrap laid practically the same numbers of eggs as a lot having 10.6 per cent of a 70 to 75 per cent protein meat scrap added to the mash. The mortality in the respective pens was 25.7 and 10.7 per cent. Another lot receiving an addition to the mash of 15 per cent of a meat scrap containing 50 to 55 per cent of protein laid an average of 10.5 less eggs per hen, and the mortality was intermediate between the other two lots.

Yeast feeding trials.—The preliminary results are reported of the first 90 days of a comparison of the value of adding granulated, dried yeast to the ration of laying hens. With the Leghorns the production was practically equal with or without the yeast feeding, but with Plymouth Rocks and Rhode Island Reds the production was increased from 31.7 eggs per bird in the lot without yeast to 35.1 eggs per bird when yeast was supplied. No influence of the yeast was detected on the weights of the birds or the hatchability of the eggs. With well balanced rations, W. E. Lloyd found no advantage in giving yeast to young growing and fattening rabbits.

Observations on tint in white eggs.—From records of the tint of the first egg laid each week by a number of hens, it was found that the tendency of the eggs is to fade out from January to April. Some hens laying tinted eggs at the season of low production in January will lay white eggs at the season of high production in April.

Monthly production of high and low producers.—A comparison of the monthly production of high and low producing pullets in the egg-laying tests showed that the low producers were low in production every month, but the greatest falling off was during the summer and fall.

Relation of age to production and hatching qualities.—The trap-nest records of a number of hens during their 4 years' production showed that 95 per cent of them produced over 130 eggs in the first 2 years, 84 per cent over 130 eggs through the first 3 years, and 55 per cent over 130 eggs in their first 4 years. Gradual declines in the fertility and hatchability of their eggs were noted after the second year. The offspring of these hens, however, have apparently inherited normal vigor and fecundity.

Correlation between summer and annual production.—In a study of the relation between the summer and annual production of hens, the following correlation coefficients have been calculated over a period of four years by the 224 hens reported in the above experiment: First year 0.487 ± 0.034 , second year 0.497 ± 0.034 , third year 0.581 ± 0.0298 , and fourth year 0.663 ± 0.0253 .

Hatching turkey eggs artificially.—In five hatching trials with turkey eggs in an artificial incubator, W. E. Lloyd found that hatches of from 55 to 73 per cent of the eggs set have resulted, indicating an ability to successfully hatch turkey eggs artificially.

Oyster shell v. limestone grit as a source of lime for poultry.—The numbers, percentage of weak shelled eggs, and hatchability of the eggs laid by two lots of birds from March 21 to September 30 were compared. One lot had access to a self-feeder containing limestone, while the other lot had access to both limestone grit and oyster shells. The pen receiving grit consumed 191.7 lbs. of grit per 100 birds and made an average production of 46.4 per cent. The percentage of weak shelled eggs showed considerable variation among the two pens, and no significantly larger numbers of weak shelled eggs were produced in the pen receiving grit. The birds receiving grit and shell consumed 17.1 lbs. of grit and 138 lbs. of shell per 100 birds and gave an average production of 40.4 per cent. The eggs laid by the pen receiving only the limestone grit were equal in every way to those laid by the other hens, and the health of the birds was also equally good.

Calcium metabolism in the laying hen, H. G. D. BUCKNER, J. H. MARTIN, and A. M. PETER (*Kentucky Sta. Bul.* 252 (1924), pp. 3-36, figs. 2).—In continuing this series of studies (*E. S. R.*, 51, p. 176) on the effect of calcium feeds on egg production and the calcium content of the eggs, four lots of 10 Single Comb White Leghorn pullets each were selected. All lots received yellow shelled corn throughout the experiment. The balance of the rations was supplied ad libitum and consisted from November 1, 1921, to May 30, 1922, of

buttermilk in one lot, buttermilk and limestone in lot 2, mash consisting of tankage and ground yellow corn (1:4) in lot 3, and mash and limestone in lot 4. The rations were changed during June and July, 1922, so as to consist, in addition to the corn fed to all lots, of buttermilk and limestone in lot 1, buttermilk in lot 2, mash and limestone in lot 3, and buttermilk and limestone in lot 4. The birds were confined without access to runs so that no additional feeds could be obtained.

The data recorded include the weights of the hens; amounts and CaO and P_2O_5 contents of the feeds consumed; mortality; egg records; weights and CaO and P_2O_5 contents of the eggs, shells, and liquid contents of the eggs by months; and the CO_2 free ash, CaO , and P_2O_5 contents of the carcasses and leg bones of control hens killed at the start of the experiment and of control and experimental hens from each lot at the time of changing the rations on May 30. The data for each hen are also tabulated as far as possible.

Very significant differences in the amounts of the different feeds consumed by the various lots were apparent. The corn consumption of lots 1 and 2 were very similar during the first seven months, gradually diminishing from December to May when a distinct increase occurred. The buttermilk consumption of these two lots showed the same general trend, increasing to April but decreasing in May, though the total consumption was 26 per cent greater in the lot not receiving limestone. The changing of these rations by taking limestone from lot 2 and adding it to lot 1 produced a marked increase in the buttermilk consumption of lot 2, with only a small decrease in the buttermilk consumption of lot 1. The corn consumption of lots 3 and 4 was somewhat less than lots 1 and 2. The mash consumption of lot 3 was 74 per cent greater than in lot 4, which received limestone. The substitution of buttermilk for mash in lot 4 resulted in an increase in the consumption of corn, while the addition of limestone to lot 3 also resulted in an increased consumption of grain and a decreased consumption of mash. The limestone consumption of lots 4 and 3 was very similar, though one received buttermilk and the other mash.

As to the condition of the fowls during the first seven months, one hen died in each of lots 2, 3, and 4, while three died from lot 1, two of the latter three probably being due to a calcium deficiency. The birds in lot 1 were in the poorest condition after the first four months, and by May 24 one of the hens from this lot was unable to stand. These birds also started eating eggs in March. Lot 2 was in better condition than lots 3 and 4, though the difference between these lots was slight.

The average monthly egg records per hen from November to May were lot 1 6.3, lot 2 12.4, lot 3 5.5, and lot 4 6.3. During June and July the average monthly records were 16.5, 14.3, 3.4, and 12.3 eggs, respectively. It is thus indicated that the lack of calcium limited egg production when the rations containing buttermilk (lots 1 and 2) were fed more than when the ration included mash containing tankage (lots 3 and 4). Lot 2, however, consumed more animal protein than lot 4, the amount being calculated as 1,075 gm. by the former lot and 303 gm. by the latter. The eggs from the lots receiving limestone both during the main part of the test and after changing the rations were distinctly heavier. This was due both to the weights of the shell and the liquid contents of the eggs. The addition of limestone to the ration of lot 1 increased the weight of the shell 28 per cent and the contents 8.7 per cent during June and July as compared with April and May. Taking limestone out of the ration of lot 2 decreased the weights of the shell and contents of the eggs 22 and 5.1 per cent, respectively. Analyses of the eggs showed that the P_2O_5 in the shell and liquid part of the eggs was relatively

uniform both on a percentage and total basis, while the percentage of CaO in the eggshell was greater from the two lots receiving mash (lots 3 and 4), but the amount per egg was greater in the two lots receiving limestone (lots 2 and 4). Although the calcium deficiency decreased the number of eggs laid and the shell content, only two soft-shelled eggs were found. A calculation of the amounts of calcium and phosphorus required for egg production showed that 71, 66, 59, and 33 per cent of the CaO and 4.7, 10, 4.7, and 6.4 per cent of the P_2O_5 intake were used in the eggs, respectively, in lots 1, 2, 3, and 4. Considerable CaO over that supplied by the feed was utilized from the limestone in lots 2 and 4.

The growth of the hens receiving buttermilk, especially with limestone, was more rapid than those receiving mash as judged by body weights. Analyses of the carcasses showed that the leg bones of the birds in lots 1 and 3 were lighter than those in lots 2 and 4. The CaO and P_2O_5 content of the leg bones of lot 1 was less than that of the controls, indicating a withdrawal of these elements from the skeleton due to a deficiency of calcium in the ration. The practical necessity of adding some form of calcium to a corn and buttermilk or corn and mash ration containing tankage for the production of a satisfactory balance and maximum egg production is pointed out.

Studies on a nutritional disease of poultry caused by vitamin A deficiency, J. R. BEACH (*California Sta. Bul.* 378 (1924), pp. 3-22, figs. 7).—This is a more complete account of the experiment previously noted (E. S. R., 50, p. 871), giving in addition the results of preliminary experiments which pointed toward a nutritional deficiency as the cause of the disease resembling roup.

Feeding market egg layers for winter production, MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 3, pp. 57-62).—The principles of feeding and suggestions for care of winter egg producers are discussed. Formulas for mixing feeds are also given.

Poultry culling is profitable, E. C. FOREMAN (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 8-12, figs. 3).—This is a discussion of the principles and practice of culling poultry.

The relation of antecedent egg production to the sex ratio of the domestic fowl, M. A. JULL (*Jour. Agr. Research* [U. S.], 28 (1924), No. 3, pp. 199-224).—This is a more complete report of the study previously noted (E. S. R., 49, p. 864), the additional material consisting largely of a consideration of the relation of various factors to the sex ratio. No apparent correlation was found between the sex ratio and egg weight, yolk weight, water content of the yolk, environmental conditions, or prenatal mortality.

The identification of sex at hatching in the matings between Barred Plymouth Rock pullets and Brown Leghorn cockerels by the head and shank color made it possible to easily determine any cases of sex reversal. The author concludes from the results that no indications of such were evident. The cause of the excess of males hatched from eggs laid at the beginning of egg production, with the reverse occurring at the end of egg production, is discussed, and it is suggested that the composition of the nucleus or cytoplasm of the egg may change as the production period advances, and the change in the reaction on the chromosomes may operate in causing the female producing chromosome to be extruded in the polar body more frequently at the beginning of production and less frequently as production advances.

Amount of carbon dioxide given off by eggs during incubation, H. ATWOOD and C. E. WEAKLEY, JR. (*West Virginia Sta. Bul.* 185 (1924), pp. 15, figs. 5).—The amounts of carbon dioxide given off daily during incubation have been determined for 63 eggs that hatched normal chicks. In making the

determinations each egg was placed in a glass tube and only CO_2 free air with temperature and humidity controlled was allowed to enter. The air was drawn through the tube by means of a suction pump and the CO_2 given off by the eggs determined by first passing the air through two calcium chloride tubes saturated with carbon dioxide to remove the moisture, through moist soda lime, and through two more calcium chloride tubes. The increased weights of the soda lime and the calcium chloride tube which followed it indicated the CO_2 given off. The usual care in turning eggs during incubation, etc., was practiced.

The average amounts of CO_2 given off daily per egg from the first to the twenty-first day of incubation were, respectively, 0.0128 ± 0.0003 , 0.0085 ± 0.0002 , 0.0119 ± 0.0002 , 0.0210 ± 0.0003 , 0.0312 ± 0.0002 , 0.0391 ± 0.0002 , 0.0513 ± 0.0004 , 0.0681 ± 0.0005 , 0.0916 ± 0.0008 , 0.1261 ± 0.0012 , 0.1758 ± 0.0028 , 0.2488 ± 0.0026 , 0.3377 ± 0.0036 , 0.4580 ± 0.0051 , 0.5739 ± 0.0057 , 0.6706 ± 0.0047 , 0.7277 ± 0.0057 , 0.7563 ± 0.0041 , 0.7801 ± 0.0065 , 1.0036 ± 0.0171 , and 1.4260 ± 0.0216 gm. Infertile eggs were found to give off very little CO_2 while weak germs give off a normal amount for a few days with a rapid decrease after that time. A correlation of 0.641 ± 0.050 was found between the total amounts of CO_2 given off during incubation and the weights of the eggs.

DAIRY FARMING—DAIRYING

Values of various new feeds for dairy cows, T. E. WOODWARD, H. T. CONVERSE, W. R. HALE, and J. B. McNULTY (*U. S. Dept. Agr. Bul. 1272 (1924), pp. 16*).—Various new feeds have been compared with other more common feeds in trials with dairy cows for the production of milk and fat and gains in live weight. In all experiments two groups of cows were selected, one group receiving each feed compared, for from 30- to 70-day periods, while the other group received the other feed in addition to a basal ration. During a second period the rations of the two groups were reversed. The results presented include analyses of fish meal, cottonseed meal, peanut feed, potato meal, and corn meal, amounts of feed consumed, milk and butterfat yields, and gains in live weight of the groups on each ration. Based on the feed consumed per pound of butterfat produced the following equivalents were calculated: 1 lb. of fish meal equals 1.24 lbs. of cottonseed meal, 1 lb. of cottonseed meal equals 1.26 lbs. of peanut feed, 1 lb. of corn meal equals 1.28 lbs. of potato meal, 1 lb. of cottonseed meal equals 1.54 lbs. of velvet bean meal, and 1 lb. of corn meal equals 10 lbs. of hydrolyzed sawdust.

In other experiments, due to the use of smaller numbers of animals or irregularities in the live weights, such definite equivalents were not determined, but in general sweet potato meal was found approximately equivalent to corn meal, and potato silage was about equal to corn silage. Apple pectin pulp was distinctly inferior to beet pulp as it was less palatable, the production was less, and the animals lost weight. In two trials it was found uneconomical to supplement an already suitable ration with molasses. This feed, however, does render poor quality feeds more palatable and induces a greater consumption.

[Feeding experiments with dairy cattle at the California Station] (*California Sta. Rpt. 1923, pp. 81-83*).—The results of two feeding experiments with dairy cattle are reported.

The nutritive value of sunflower silage for dairy cows.—This is a repetition of the experiment previously noted (*E. S. R., 48, p. 576*), except that the sunflower silage was made from sunflowers cut when the seed had reached the dough stage. This silage proved to be more palatable than that cut at the early bloom stage in the first trial, but the average consumption was 18 lbs.

daily as against 25 lbs. of corn silage. The experiment was conducted by F. W. Woll, W. E. Tomson, and M. A. Haney.

The nutritive value of orange pulp for dairy cows.—In a three months' experiment, carried on by F. W. Woll, the results indicated that the feeding of orange pulp effected an increase in the fat content of the milk. The increases in some cases appeared to be as high as 1 per cent.

The sunflower as a silage crop: Feeding value for dairy cows; composition and digestibility when ensiled at different stages of maturity, W. B. NEVENS (*Illinois Sta. Bul.* 253 (1924), pp. 185-225, figs. 2).—The results of a study of the physical and chemical properties of sunflower silage cut at different stages of growth and of the relative milk and fat producing ability, palatability, and physiological effects on the animals of corn and sunflower silage are reported.

The sunflowers were harvested at three different stages of growth, i. e. 87 days after planting when 23 per cent of the sunflowers were in bloom, 106 days after planting when 95 per cent were in bloom, and 126 days after planting when the seeds were mostly between the dough stage and maturity.

In the feeding trials two lots of cows were fed by the double reversal method, the periods being 28 days in length with 7-day transition periods. The cows received as much silage as they would readily consume in addition to a hay and grain mixture, the amount of the latter being regulated by the milk production.

The results showed that the milk and fat yields and gains in weights of the cows were always higher when the corn silage was fed, the superiority for milk and fat, respectively, being 15 and 10 per cent over the first cutting, 21 and 13 per cent over the second cutting, and 25 and 11 per cent over the third cutting of sunflower silage. The main reason for the lower yields from the sunflower silage seemed to be a lack of palatability. The average corn silage consumption per cow varied from 29.7 lbs. to 32.2 lbs. per day in the different periods, while the following average amounts of different cuttings of the sunflower silage were consumed by each of the two groups, respectively: First cutting 28.4 and 27.3 lbs., second cutting 27.3 and 22.8 lbs., and third cutting 12.3 and 10.2 lbs. The sunflowers also contained more water and less digestible nutrients than the corn silage. The different cuttings ranked in order of palatability and feeding value according to the stage of maturity, the first cutting being the most desirable. The following table gives the average composition of the different cuttings of the sunflower silage and the corn silage:

Comparative composition of sunflower silage and corn silage expressed in percentage of the fresh substance

Description of sample	Dry matter	Crude protein	True protein	Crude fiber	N-free extract	Ether extract	Ash
Sunflower silage, first cutting, average of 5 samples	Per ct. 21.14	Per ct. 1.88	Per ct. 1.28	Per ct. 7.56	Per ct. 8.72	Per ct. 0.81	Per ct. 2.18
Sunflower silage, second cutting, average of 4 samples	22.70	1.63	1.24	9.15	8.56	1.13	2.23
Sunflower silage, third cutting, average of 2 samples	30.90	2.09	1.72	13.41	11.01	1.54	2.85
Corn silage, average of 6 samples	32.30	2.85	1.51	7.04	19.46	.95	2.01

¹ Average of 2 samples.

During ensiling there was a loss of juice from the more immature silage. A loss of crude protein and nitrogen-free extract was apparent from the

chemical analyses. Digestibility of the sunflower silage of the first and second cuttings as determined with three dry cows was rather variable, but a greater digestibility of the protein, fiber, and nitrogen-free extract occurred with the more immature silage.

In regard to the physiological action of the sunflower silage, it was found to be more constipating than corn silage. There was also a slight increase in the solids content of the milk, but this was probably due to the reduction in the amount of milk. No abnormal flavor was noticed in the milk.

Sunflowers as a silage crop for dairy cows, W. B. NEVENS (*Illinois Sta. Bul.* 253, abs. (1924), pp. 4, figs. 2).—This is a popular abstract of the above.

Corn silage in a dairy ration, W. E. CARROLL (*Utah Sta. Bul.* 190 (1924), pp. 3-11).—The results of tests conducted in the winters of 1914-15 and 1915-16 to study the value of adding corn silage to a hay and grain ration for milk and fat production are recorded. Both of the lots of seven cows each received the rations with and without corn silage during 4-week test periods with 7-day transition periods.

Results for both years show a small but uniformly higher milk and fat production when the silage was fed. The cows also made slightly greater gains in weight. The milk produced on the silage ration contained 0.1 per cent more fat. From a study of the results it was calculated that 1 ton of alfalfa hay was equivalent to from 2.5 to 3 tons of corn silage.

Feeding cull beans to dairy cows, O. E. REED and J. E. BURNETT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 12-14).—The results of a second trial of the feeding value of cull beans for milk production (E. S. R., 50, p. 474) indicated that when 2 lbs. of cull beans replaced 1 lb. of cottonseed meal in a ration of corn, oats, and linseed meal along with silage and alfalfa hay, the production was maintained.

[Experiments of the dairy industry department, California Station] (*California Sta. Rpt.* 1923, pp. 112, 113, 115, 116).—These investigations include the following:

The manufacture of Jack cheese from goat's milk.—C. A. Phillips and C. E. Tegner found that a good grade of Jack cheese could be made from goat's milk. The proportion of good marketable cheese is, however, not sufficiently high to justify the commercial manufacture.

A comparison of the spray and flood methods of cooling milk.—In 16 tests comparing the spray and flood methods of cooling milk in a 200-gal. glass enameled tank pasteurizer, A. W. Farrell found the spray method to be more efficient, 19.52 B. t. u. being absorbed per pound of water from 1 lb. of milk in lowering the temperature 32° F. when using the spray method, while only 16.55 B. t. u. were absorbed when the flood method was used. In cooling, 25.5 minutes were required by the spray method and 40 minutes by the flood method. When the room temperature was higher the superiority of the spray method was still greater. More heat was carried away by the water in the flood method, but a larger percentage of it was taken from the air.

Tests of efficiency of insulated and uninsulated concrete milk cooling tanks.—A decided advantage for the use of concrete tanks insulated with cork board imbedded in the concrete was shown by Farrell in comparative tests of the rise of temperature of the water in insulated and in noninsulated tanks.

Bacteria content of strainer cotton.—Of 10 samples of strainer cotton tested for its bacterial content by pouring nutrient agar over 1-gm. portions of the cotton in Petri dishes, 5 were found by C. S. Mudge to be sterile, while the remaining types had but few organisms on them, all of which proved to be *Bacillus subtilis*.

Use of vacuum in the manufacture of butter.—Cream churned in a partial vacuum has been found by G. D. Turnbow and L. A. Raffetto to churn more rapidly, but unless the normal churning temperature was lowered the loss of fat in the buttermilk was greater. The cream broke faster but the butter granules gathered slower. The butterfat granules in the vacuum butter were uniformly larger than those in normal churnings from the same cream.

The butterfat content of various parts of bottled milk.—Analyses by C. L. Roadhouse and R. W. Clowes of various parts of bottled milk at points $\frac{1}{2}$ in. above the lower and $\frac{1}{2}$ in. below the upper line of the cream layer and $\frac{1}{2}$ in. above the lower line and $\frac{1}{2}$ in. above the middle line of the milk layer showed that the Jersey cream averaged 21.5 per cent, the Ayrshire 19.33, and the Guernsey 19.66 per cent fat. Holstein milk showed a high fat percentage in the cream layer and low in the milk, indicating a high degree of separation. After holding samples of the milk for 20 hours at 50°, samples taken from $\frac{1}{2}$ in. below the upper surface of the cream varied from 25 to 36 per cent fat, while that drawn from $\frac{1}{2}$ in. above the lower surface showed approximately 20 per cent in all breeds. Mixed samples of the cream and under milk of the four breeds were also analyzed. A period of 40 hours at 50° produced a more complete separation of the cream than when held for a shorter time.

Flavobacterium suaveolens, a new species of aromatic bacillus isolated from dairy wastes, L. SOPPELAND (*Jour. Agr. Research* [U. S.], 28 (1924), No. 3, pp. 275, 276).—In bacteriological studies at the Iowa Experiment Station a motile rod having rounded ends and producing an aromatic sweet scented odor from all protein media during the first two days of incubation has been isolated from dairy wastes. The morphological and cultural characteristics and the physiological reactions of this organism, *F. suaveolens*, are described.

VETERINARY MEDICINE

[Investigations of diseases of animals at the California Station] (*California Sta. Rpt. 1923*, pp. 240-242, 243-246).—Brief reference is made to an epidemic of equine infectious anemia which occurred during the summer and fall of 1922, causing severe losses in horses in the Honey Lake Valley in Lassen County. Investigations were made of icterohemaglobinuria or red water disease in cattle, which occurred in various parts of the State, a field laboratory being established in Scott Valley, Siskiyou County, for its study. The treatment of shotes weighing from 70 to 125 lbs. with 10 cc. of carbon tetrachloride in sufficient castor oil to make 2 oz. resulted in the death of 10 of the 24 animals, showing that this is not a safe drug to give hogs for the removal of ascarids. Fifty-six shotes given 1 dr. of oil of chenopodium, 1 dr. of spirits of turpentine, and sufficient castor oil to make 2 oz. recovered after having passed large quantities of worms. Serious loss occurred among pigs during the first few days of life at garbage feeding plants, where part of the animals were raised from garbage-fed sows. A considerable number of the pigs that survived this period were lost between the ages of three and six weeks from white scours. Post-mortems showed evidence of navel infection in all cases, and it was recommended that the sows' teats be washed before farrowing with a 3 per cent solution of cresol and that the surroundings be sprayed with the same solution. Although this was done and the navel was disinfected with tincture of iodine immediately after birth, the losses continued. A system of feeding of sows has been followed in connection with sanitary measures which has practically eliminated the loss of pigs.

In investigations by J. R. Beach, J. Traum, and J. C. Corl, chickens given pulmonary bovine tuberculosis material with their feed, others inoculated,

some subcutaneously and some intraperitoneally, and others which had immense numbers of the organisms introduced directly into their crops all failed to contract the disease. The amount of chicken pox vaccine used by poultrymen continues to increase. Field tests of vaccine have shown that, while a considerable percentage of the fowls vaccinated were not protected against chicken pox, there was a sufficient difference between the number of diseased among the vaccinated fowls and the controls to make the use of the vaccine in flocks infected with chicken pox worth while. A brief account is given of studies of fowl cholera as associated with ruptured yolk. *Bacterium avisepticum* was isolated by C. D. Carpenter from edematous wattles of a cockerel and a hen, the former having died, but the hen appeared otherwise normal and recovered. Cultures of three other strains of *B. avisepticum* isolated from hens with ruptured yolk when injected into the wattles of normal cockerels produced edema of the wattles and death in from two to six days, *B. avisepticum* being recovered in all cases. Cultures of eight other strains of *B. avisepticum* isolated from hens with ruptured yolk failed to produce either edema of the wattles or death when injected into the wattles or subcutaneously.

Studies of coccidiosis by J. C. Corl and J. R. Beach are briefly reported upon. Practically all losses from the disease occurred between the sixth and fifteenth days after inoculation. Chicks fed buttermilk or sweet milk weighed from 11.5 to 96 per cent more than those of any other lot at the termination of the experiments.

Ninth and tenth reports of the director of veterinary education and research, April, 1923 (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 9-10 (1923), pp. 824, pls. 57, figs. 149*).—The papers presented in this report (E. S. R., 44, p. 76) include several noted elsewhere in this issue and the following: "Gouwziekte" Veld: Its Vegetation and Flora, by I. B. P. Evans (pp. 107-119); The So-called "Staggers" or "Pushing Disease" of Cattle in Natal; An Intoxication Due to the Ingestion of *Matricaria nigellaefolia* D. C. (E. S. R., 46, p. 776), by W. H. Andrews (pp. 121-220); Tsetse in the Transvaal and Surrounding Territories: An Historical Review (E. S. R., 51, p. 57), by C. Fuller (pp. 315-376); The Toxicity of *Adenia digitata* Burt-Davy (*Modecca digitata* Harv.), by H. H. Green and W. H. Andrews (pp. 379-392); The Blood of Equines (E. S. R., 49, p. 683), by C. P. Nesor (pp. 479-556); The Susceptibility of Calves to Contagious Abortion When Fed on Milk from Infected Cows (E. S. R., 49, p. 680), by J. Quinlan (pp. 557-600); Note on the Composition of Various Samples of Arsenite of Soda (pp. 775-780), On the Determination of Arsenic, Chiefly in Dipwashes (pp. 781-795), and Oxidation in Arsenical Dipping Tanks (pp. 797-808), all by J. P. van Zyl; and Preliminary Notes on the Life History of *Oesophagostomum columbianum*, by F. Veglia (pp. 809-824).

[**Abortion studies at the California Station**] (*California Sta. Rpt. 1923, pp. 238-240*).—Several independent studies on different phases of the abortion problem are reported as follows:

The abortion agglutination test in relation to the discharge of Bacterium abortum from the bodies of cows.—In this study, which was conducted by F. M. Hayes and E. H. Barger, regular agglutination tests were made simultaneously on the blood serum and milk from all the cattle in the dairy herd. Milk, aborted fetuses, placentas, and uterine discharges were also tested for the presence of *B. abortum*. Some of the results of the study are summarized as follows: Number of mature cows persistently negative 35, and persistently positive 15; number of mature cows positive in blood serum only 5, in milk serum only 0, and in both blood and milk 10; number positive in milk and discharg-

ing and not discharging *B. abortum* 7 and 3, respectively; number negative in milk and blood and discharging *B. abortum* 1; percentage of cows positive in either blood or milk and discharging *B. abortum* in milk 46; and percentage of cows positive in milk and discharging *B. abortum* 70.

The principal conclusion drawn is that periodic agglutination tests upon the blood serum will identify practically all carriers and that this test, with the removal of the reactors, should be used in herds where the infection is not too great. The arguments for the choice of blood instead of milk are that in every case in which the organism was isolated from the milk a positive reaction was obtained, but the organism was not isolated in every case in which the milk gave a positive test; that in most cases where blood and milk were both positive the milk showed a lower titer; and that the organism was never found discharged from the genital passages in cows giving a negative blood test.

Bacterium abortum isolated from the feces of suckling calves.—In an experiment conducted by R. Clowes under the direction of E. H. Barger and F. M. Hayes, *B. abortum* was isolated from the feces of young bull calves which had been fed milk artificially infected with fresh cultures of the organism. This is thought to be of significance in pointing to a source of infection which has not been considered hitherto, namely, the intestinal discharge of calves drinking infected milk.

Controlled vaccination experiments on cattle with Bacterium abortum.—In this study of the value of living organisms in producing immunity, 20 cows were vaccinated with live abortion germ vaccine and then exposed to infection, 10 were vaccinated and not exposed, and 10 others were exposed and not vaccinated. The exposure to infection consisted in giving by mouth, once only, naturally infected milk, salt solution emulsions of tissues from aborted fetuses containing *B. abortum*, and laboratory cultures of the organism. All of the animals in the third group were pregnant at the time of infection. In the first group 17 became pregnant, and in the second 4. Of the pregnant animals in the first group, 1 was accidentally killed before calving, 1 gave birth at term to a fully developed dead calf, and the others calved normally. All of the second group calved normally. In the third or control group, only 2 calved normally at term.

These results are thought to demonstrate the protective value of live abortion vaccine and the ability of the organism to become established in susceptible animals following a single exposure.

Further observations on the molts of the ox bots *Hypoderma bovis* De Geer and *H. lineatum* Villers, E. W. LAAKE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 3, pp. 271-274).—In this paper the author presents further facts substantiating the claim that there are five larval stages in these two species of *Hypoderma*, supplementing the account previously noted (E. S. R., 45, p. 555).

Field and laboratory notes on a fatal disease of cattle occurring on the coastal plains of Texas (loin disease), H. SCHMIDT (*Texas Sta. Bul.* 319 (1924), pp. 3-32, figs. 8).—This is a preliminary report upon investigations of a disease of cattle occurring in Texas, locally known as loin disease, which manifests itself by a sudden and complete breakdown of the organs of locomotion. A brief account by Kinsley has been noted (E. S. R., 45, p. 886).

The disease is prevalent from May to September in the low flat area bordering on the Gulf of Mexico, and affects cattle over 18 months of age in case such cattle have been subsisting entirely on the native vegetation for a period of at least one year. The outbreaks of the affection simulate an infectious

disease, but in repeated experiments the author has been unable to demonstrate the presence of a pathogenic organism. From the results of a feeding experiment with putrid bones, its cause is tentatively ascribed to toxins produced by bacterial action in carcass material on the prairie and the consumption of such putrid material by cattle. It is tentatively recommended to feed sweet bone meal to cattle in order to stop them from eating dangerous carcass material, also to clean thoroughly all pastures of animal carcasses.

In an appended note, mention is made of a visit to the Texas Station by A. Theiler, director of veterinary education and research, Union of South Africa, who considers the affection to be identical with lamziekte, a disease very prevalent in South Africa, and accounts of which have been noted in his reports as director of veterinary research (E. S. R., 41, p. 873). It is observed that the symptoms of loin disease and lamziekte are very similar, if not identical. Experimental feeding of bone meal, which has been found to be a remedial measure in South Africa, will be conducted by the author.

Mycotic stomatitis of cattle, J. R. MOHLER (*U. S. Dept. Agr., Dept. Circ.* 322 (1924), pp. 7, fig. 1).—This circular is a reprint, with slight revision, of the account previously noted as B. A. I. Circular 51 (E. S. R., 16, p. 610).

Snotsiekte in cattle, R. W. M. METTAM (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 393-432, pl. 1).—Snotsiekte is an acute febrile specific disease of cattle, which almost invariably proves fatal. It breaks out when cattle and black wildebeest are associated together in the presence of an unknown vector, which at present is regarded as an ectoparasite of the wildebeest. Experimentally, the disease can only be set up in cattle by the intravenous and subcutaneous inoculation of blood. The cause is an ultra-visible but nonfilterable organism located in the red blood corpuscles, but occasioning only a slight hemolysis in some cases.

Sweating sickness in calves.—Preliminary report, P. J. DU TOIT (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 231-250, pls. 3).—This is a report of studies of a specific disease of calves, the etiology of which is still unknown.

Gousiekte in sheep, A. THEILER, P. J. DU TOIT, and D. T. MITCHELL (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 7-105, pls. 4, fig. 1).—This is a report of investigations of a disease of sheep caused by feeding on the plant *Vangueria pygmaea* (Rubiaceae). This plant contains a toxic principle which acts on the heart, giving rise to a productive myocarditis and subsequent dilation of the ventricles, and ending most frequently with failure of the heart. It is said that under ordinary conditions the animals frequently are not observed to be ill, and when handled in the usual way sudden deaths occur.

Sheep scab: The infectivity of kraals, P. J. DU TOIT (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 221-229, pls. 10).—An experiment conducted by the author is considered to prove conclusively that an infected sheep kraal, if kept free of sheep for a period of 17 days, will no longer be able to infect clean sheep.

Anthelmintic experiments with hogs, D. C. MOTE (*Ohio Sta. Bul.* 378 (1924), pp. 153-182).—The author reports upon experiments conducted with some of the anthelmintics that are commonly recommended for removing worms in the alimentary tract of hogs and sheep, including santonin; santonin and calomel; santonin, areca nut, calomel, and soda; santonin, calomel, and soda; calomel and aloes; copper sulfate; arsenic; turpentine; iron sulfate; pumpkin seeds; and oil of chenopodium. With the exception of copper sulfate and oil of chenopodium, the drugs were administered with the feed, usually preceded by a dose of salts and a fast, followed by a dose of salts. The oil

of chenopodium, mixed with castor oil and, in one test, a copper sulfate solution was administered by means of a drenching bottle.

Since the data obtained on many of the drugs are very meager, the author hesitates to draw any conclusions as to the results. However, he feels warranted in stating that simple purgatives, such as Epsom and Glauber's salts, calomel, and aloes, have little value as anthelmintics. Ascarids in hogs may sometimes be removed by Epsom salts given as a purgative, but the number removed is too small compared to the total number infesting the animal to justify its use as a worm remover. Santonin seldom fails to remove ascarids from hogs, and it is more efficacious in repeated doses. In the 15 tests in which santonin was used its efficacy ranged from 0 to 46.6 per cent. The combination of santonin, calomel, areca nut, and sodium bicarbonate proved to be less effective than the claims made for it. In the one test in which it was used copperas failed to remove even a single worm. Turpentine is not an effective anthelmintic against ascarids in hogs, and the fact that it may cause serious symptoms of nephritis makes its use inadvisable as a worm remedy for hogs. Sal Vet in the one test in which it was used did not prove efficacious. The evidence for the homemade mineral mixtures is conflicting.

Oil of chenopodium was the most effective remedy, proving 100 per cent effective when preceded by a fast and administered orally in conjunction with castor oil. This drug does not appear to be effective when administered upon a full stomach, nor is its administration in the feed satisfactory or effective. Among the drugs and combinations which gave evidence of having some anthelmintic efficiency against ascarids in hogs under experimental conditions are the following, mentioned in the order of their efficacy: Oil of chenopodium; santonin; santonin and calomel; santonin, calomel, and sodium bicarbonate; and santonin, calomel, areca nut, and sodium bicarbonate. A summary of the results in the different treatments has been tabulated and is appended.

A contribution to the study of the virus, haematology, and pathology of infectious anaemia of equines under South African conditions, G. VAN DE W. DE KOCK (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 9-10 (1923), pp. 251-313, pls. 15*).—The author concludes that infectious anemia of equines in South Africa, with the exception of the few isolated very acute cases, may be regarded as a disease in which a gradual progressive anemia becomes manifested, from which the animal may die or make a complete recovery, except that it remains a virus carrier for a number of years. During the anemia a monocytosis develops, and to a certain extent this monocytosis seems to have its origin in the intralobular capillary endothelium of the liver, where it commences as an erythrophagocytosis.

A list of 47 references to the literature is included.

The strongylids and other nematodes parasitic in the intestinal tract of South African equines, G. THEILER (*Thesis, Facult. Sci., Univ. Neuchâtel, 1923, pp. 175, figs. 64; also in Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 9-10 (1923), pp. 601-773, figs. 64; abs. in Jour. Compar. Path. and Ther., 37 (1924), No. 2, pp. 118-120*).—The greater part of this work is taken up with a brief description, together with remarks on the distribution and life history where known, of all the known species of equine strongylids and also of the species parasitizing equines of the following genera: *Trichostrongylus*, *Dictyocaulus*, *Ascaris*, *Oxyuris*, *Crossocephalus*, *Probstmayria*, *Setaria*, and *Habronema*. The paper includes a key to the genus *Habronema*, a table showing the geographical distribution of the equine strongylids and one showing the occurrence of the parasites, an index of synonyms, and a bibliography of three pages.

Some surgical poultry problems, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 3, pp. 62-64, figs. 3).—This is a brief practical account of the more prominent of the common surgical operations performed on poultry, including dubbing or cropping, bumblefoot and suborbital sinus treatments, and relief of crop impaction.

[**Diseases of poultry**], R. GRAHAM and E. A. TUNNICLIFF (*Illinois Sta. Circs.* 285 (1924), pp. 7, figs. 5; 287, pp. 4, figs. 3; 288, pp. 8, figs. 9).—Practical accounts of important diseases of fowls are presented as follows: Tuberculosis of Fowls, Fowl Typhoid, and Coccidiosis of Poultry.

[**Diseases of poultry**], R. GRAHAM and I. B. BOUGHTON (*Illinois Sta. Circs.* 286 (1924), pp. 8, figs. 5; 289, pp. 4, figs. 5).—Practical accounts are given of Fowl Cholera and of Botulism in Fowls, Types A and C, Commonly Called Limberneck.

Occurrence of nodular typhlitis in pheasants due to *Heterakis isolonche* in North America, B. SCHWARTZ (*Jour. Amer. Vet. Med. Assoc.*, 65 (1924), No. 5, pp. 622-628, figs. 3).—The author records the occurrence in Pennsylvania, Darien, Conn., and Canada of *H. isolonche*. The disease caused by this parasite was first observed in Germany and France over 30 years ago and has since been found in other localities. That infestation by this parasite is responsible for the deaths of pheasants is shown by the records presented in this paper and those published by other investigators. Published records attributing the cause of nodular typhlitis of pheasants to *H. gallinae* are based on faulty specific determinations, as already shown by Lucet and Henry (*E. S. R.*, 26, p. 684). The records of various stages of *H. isolonche* obtained from nodules have led to the conclusion that early stage larvae penetrate the mucosa of the ceca and encyst in the submucosa, where they continue to grow and attain their sexual maturity.

A list is given of 11 references to the literature cited.

South African parasitic nematodes, H. O. MONNIG (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 433-478, figs. 46).—This is a report upon nematodes collected during a period of several years in South Africa, under the direction of A. Theiler, from a large variety of hosts, representing reptiles, birds, and mammals. These nematodes, which were with a few exceptions intestinal forms, represented 32 different species, of which 4 are new, 3 being placed in new genera.

RURAL ENGINEERING

Agricultural engineering [studies at the California Station] (*California Sta. Rpt.* 1923, pp. 49, 50-56, figs. 6).—Among a number of other subjects which have been discussed elsewhere, data are reported by A. H. Hoffman on methods for the measurement of soil pulverization. After preliminary trials two methods were adopted. The first determines the percentage of soil caught on each of a set of seven screens placed one above another. The screens are of wire, square mesh of 8-, 4-, 2-, 1-, 0.5-, and 0.25-in. sizes, with solid bottom pan. Soil samples weighing from 50 to 60 lbs. each, taken in such a way as to represent the whole depth of furrow slice, are used. The second method measures the density of the soil before and after tilling, the ratio obtained indicating the pulverization.

Data on the effect of carburetor adjustment on fuel consumption in a tractor engine, by L. J. Fletcher, indicate the importance of proper carburetor adjustment on fuel economy and the impossibility of readily detecting rich mixtures by engine performance.

Surface water supply of Hawaii, July 1, 1920, to June 30, 1921 (*U. S. Geol. Survey, Water-Supply Paper 535 (1924), pp. IV+151*).—This report, prepared in cooperation with the Territory of Hawaii, contains the results of measurements of flow of certain streams and ditches on the Islands of Kauai, Oahu, Molokai, and Maui during the year ended June 30, 1921.

Curing conditions of concrete drain tile, D. G. MILLER (*Concrete [Detroit]*, 24 (1924), No. 6, pp. 235-238, figs. 11).—Experiments conducted by the U. S. D. A. Bureau of Public Roads in cooperation with the University of Minnesota and the Minnesota State Department of Drainage and Waters on the best curing conditions for concrete drain tile are reported.

The results indicated that strength of concrete drain tile is a reasonably good indicator of resistance to sulfate waters. Consequently variations in the mix, consistency, and grading of the aggregate which tend to increase the compressive strength also tend to prolong the life of the specimens.

It is noted that cylinders cured longest in water attained the highest strength at 28 days but showed the least resistance to the action of a 1 per cent solution of sodium sulfate, the resistance being closely proportional to the length of time the cylinders were stored in air. Even when concrete was kept continuously wet for as long as 12 months and then stored without drying in sulfate solutions the increase in resistance as compared with specimens cured in water for 20 days was slight.

The results to date are taken to indicate that for water-cured concrete for exposure to the action of sulfates two distinct phases of the curing period should be given consideration. The first of these is the length of time the concrete is kept moist, and the second is the treatment following the curing period proper. Regardless of the length of time cured under moist conditions, concrete must be allowed subsequently to thoroughly dry and harden in the air if great resistance to attack by sulfates is to be expected.

Steam-cured concrete has been found to make by far the best showing in the tests. It is concluded that, if properly done, little or no strength need be sacrificed in order to steam cure concrete drain tile at a temperature nearer the boiling point of water if work now under way proves conclusively that the value of such treatment for developing resistance to sulfate waters is as great as indicated.

Tests show how damp-sand curing improves quality of concrete, F. D. CROOK and H. FAULKNER (*Engin. News-Rec.*, 92 (1924), No. 25, pp. 1050, 1051, figs. 4).—Laboratory tests of concrete mixtures to determine the influence of crank case oil on the strength of road concrete showed that air cured specimens completely saturated with the oil possessed low compressive strengths, whereas damp sand cured specimens showed only the slightest surface penetration and possessed high compressive strengths. The conclusion is drawn that oil drippings are harmless to well made concrete.

It was further found that air cured specimens were reduced to one-half their original weight after immersion for four days in a 10 per cent solution of hydrochloric acid, while damp sand cured specimens showed only a slight surface attack. Permeability and abrasion tests also emphasized the fact that damp sand curing improves the quality of concrete.

Comparative utility of concrete pavement tests, J. G. BRAGG (*Engin. News-Rec.*, 92 (1924), No. 24, pp. 1012-1014).—In a contribution from the New Jersey State Highway Commission, the results and analyses of four methods of testing concrete pavements are presented and discussed. The test methods under consideration are (1) control specimens made by the construction inspector, (2) control specimens made by a representative of the laboratory and cured in the field, (3) control specimens made by a representative of the labo-

ratory and cured in the laboratory, and (4) specimens cut from the completed pavement by a core drill.

It has been found that any of these methods is satisfactory for determining crushing strength, but that by any method a sufficient number of samples (about 10) must be taken to obtain a fair average. It is further thought that conclusions should not be based on less than 10 specimens per mile of road or approximately 1 specimen per 1,000 sq. yds. of finished pavement. It is considered impracticable to attempt to take a sufficient number of core specimens of proper size to be tested at 28 days or less for determination of crushing strength. A considerable saving is said to be accomplished and very satisfactory data are obtained by the use of control specimens in conjunction with the core drill specimens.

Investigations in stump and stone removal, M. J. THOMPSON and A. J. SCHWANTES (*Minnesota Sta. Bul. 208 (1924), pp. 43, figs. 12*).—Data are reported on (1) the cost of clearing in units of time and material on selected areas representing the principal tillable areas of northeastern Minnesota, (2) clearing costs in like units of such trees or stumps as are usually associated with the several types of soil, (3) cost of breaking under each condition, (4) stone removal, and (5) choice of first crops.

It was found that in general there is a more or less definite relationship between type of soil and predominating species of tree growth. White pine grows on a greater variety of soils than any other species. The cost of brushing was found to vary considerably, depending on the type of vegetation as well as many other factors. The brushing cost on jack pine sand was comparatively low, varying on 6 plats from 4.3 to 40 man hours per acre.

The amount of explosives required to clear an acre of stumps varied considerably, depending primarily on the size, kind, and age of stumps as well as kind and condition of soil. The variation on 10 plats was from 38.5 to 130 lbs. per acre, with an average of 84.72 lbs.

The cost per acre of stump removal averaged \$30.59, and the total average cost of stump removal on all plats was \$15.28 for labor and \$15.31 for material. Of the total clearing costs, 34 per cent was found to be for materials, 16 per cent for horse labor, and 50 per cent for man labor. Green stumps were much more expensive to remove than dead stumps. The factors affecting the cost of stump removal in the order of their importance were found to be size, kind, and age of stump, soil moisture content, and kind of soil.

The average time per stump for removing and piling varied from 6.7 man minutes and 0.76 horse minutes to 124 man minutes and 117 horse minutes, with an average on all plats of 52.26 man minutes and 32.8 horse minutes. The total cost of stump removal per stump varied from 8 cts. to \$1.69, with an average cost on all plats of 65 cts.

Electric blasting was found to be safer and under some conditions more economical than the cap and fuse method. Under some conditions it was economical to use a stump puller in combination with the explosives, especially with green stumps or where stumps were large and the soil was light and dry. Where the hauling distance was long it was found to be better to break up large stones with explosives and haul the pieces on a wagon. Explosives were more efficient on large boulders than on small ones. Undermining was more efficient than underdrilling and was almost as efficient as mud capping.

The best time of the year for breaking is considered to be June, July, and perhaps August. Attention is especially drawn to the importance of ample clearance space between the lower side of the plow beam and the point of the share when breaking cleared land.

Velocity of detonation of various types of explosives (*Engin. and Contract., Railways*, 61 (1924), No. 6, pp. 1359, 1360).—Experiments on the effect of confinement upon velocity as affecting the choice and loading of various types of dynamites are briefly reported.

Tests of straight nitroglycerin dynamites showed that 40 per cent low freezing gelatin unconfined and primed simply with a No. 6 cap has a very low velocity. Forty per cent low freezing gelatin unconfined and primed with a 60 per cent straight dynamite primer showed a higher velocity than 40 per cent straight dynamite. The confinement offered by 1.25-in. iron pipe was not sufficient to cause 40 per cent gelatin to detonate at high velocity. When confined under a concrete block, 40 per cent low freezing gelatin had a higher velocity than the corresponding grade of straight dynamite.

Low freezing ammonia dynamites exhibited approximately the same characteristics as the straight dynamites as regards increase in velocity under confinement. Sixty per cent low freezing gelatin thus showed a higher velocity than the corresponding grade of either straight or low freezing ammonia dynamite. In fact, the 40 per cent gelatin had a higher velocity in a 5-in. cartridge than either the 60 per cent ammonia or the straight. This is due in part to the higher density of the gelatin, but it is an inherent property of gelatins that their velocities in large diameters or under confinement are higher than the velocities of corresponding grades of other dynamites.

Further tests showed that when a line of cordeau is detonated alongside of gelatin dynamite the gelatin detonates at high velocity. This is taken to indicate that a charge of gelatin dynamite can be placed in a well-drilled hole and fired with high velocity by means of cordeau.

It is pointed out that confinement by water does not produce the same effect on rate of detonation as confinement in rock or earth. Under a depth of 7 ft. of water, for instance, all types of dynamite, including gelatin, showed a marked tendency to decrease in velocity as the wave of detonation traveled forward from the priming end of the column.

Temperature requirements of hot spot manifolds, C. S. KEGERREIS and O. C. BERRY (*Purdue Univ., Engin. Ext. Serv. Bul. 15* (1923), pp. 43, figs. 29).—Studies on methods of supplying heat from the exhaust of internal combustion engines to effect proper vaporization of the fuel used are reported.

The results showed that there is a definite range of temperatures for each fuel where deposition of solid matter occurs. Highest rates of vaporization occur just before the spheroidal state, which always occurs at temperatures higher than the end point of the fuel. The vapor is not readily condensed when produced from a liquid spheroidal condition.

The rates of vaporization in the spheroidal state were found to be more nearly constant than at lower temperatures. No deposition of solid matter was present with temperatures sufficient to produce the spheroidal state. These results are taken to indicate the desirability of maintaining hot spot temperatures in the spheroidal range.

Ordinary temperatures of outlet cooling water were found to have negligible effect on exhaust gas temperatures if proper carburetion was effected. When using 56 B. gasoline, a temperature of 160° F. was required for the intake air before proper combustion was insured as judged by the exhaust temperatures. An advance of ignition in general decreased the exhaust temperature, the magnitude depending on the load as well as the speed of the engine. All tests at constant power showed minimum exhaust temperatures at mixture ratios slightly richer than the high power ratio. The exhaust temperature

varied directly with the engine speed to a maximum at very high speed. The effect of the load on the exhaust temperatures was greatest at the lower speeds.

Thermostatic control of the vaporizing well was found to be unnecessary as the temperature of the exhaust was insufficient to flash the liquid if the area of the well or hot spot was properly designed. Acceleration after a long period of idling was found to be a more difficult condition to meet than the idling itself and is considered to be the most severe situation with which the designer has to contend. This is due to the lowered manifold vacuum, increase in fuel flow, and lag of exhaust temperatures in the hot spot.

It was found that the hot spot area may be computed when the engine size, type of fuel used, and exhaust temperature conditions are known. These results in general are taken to indicate that an effort should be made to heat the fuel without heating the air. One of the main reasons for this is that the fuel may be thus vaporized at a very high temperature with a small amount of heat, and this vaporization may be accomplished very rapidly. The dry fuel vapor may then be mixed with cool air and drawn into the solution before it has had time to condense and drop out of the mixture. The final mixture may thus be made usably dry at the lowest possible temperature. When the air is allowed to come in contact with the hot spot it becomes unnecessarily heated and tends to keep the metal in the hot spot at too low a temperature to be most effective in vaporizing the fuel. It is concluded that one of the principal causes of poor carburetion lies in the improper manifolding of engines.

A roller for use on peat land, J. T. STEWART (*Jour. Amer. Peat Soc.*, 17 (1924), No. 2, pp. 57-69, figs. 9).—Information, drawings, and a bill of material for the construction of a roller for use on peat land are presented.

Experiments with different rollers are also briefly reported which were conducted at the Minnesota Experiment Station. These showed that a roller for use on peat land should weigh from 700 to 800 lbs. per lineal foot. A roller 30 in. in diameter has proved satisfactory, and a rolling length of 42 in. is satisfactory for use by either team or small tractor. Two short rolls are preferable to one long roll. A shell made of 0.25 in. boiler plate steel with welded seam has been found satisfactory from the standpoint of service. The shaft should be loose and not fixed in the roll, and the roll should be filled with a dense concrete. The frame may be made of wood, steel, or a combination thereof.

A colony brooder house that starts chicks right, L. E. CARD and F. P. HANSON (*Illinois Sta. Circ.* 291 (1924), pp. 12, figs. 17).—Practical information, including working drawings and a bill of materials for a colony brooder house adapted to Illinois conditions, is presented.

RURAL ECONOMICS AND SOCIOLOGY

Land reclamation policies in the United States, R. P. TEELE (*U. S. Dept. Agr. Bul.* 1257 (1924), pp. 40, fig. 1).—Past Federal land policies are discussed as typified by homestead and land reclamation laws up to and including the Irrigation District Act of August 11, 1916. State reclamation policies have included the reclamation of swamp and overflowed lands, as well as the reclamation of arid lands. State policies with reference to irrigation and drainage are discussed in detail.

It is held that there is no justification for a national subsidy to land reclamation. If public aid is employed in financing reclamation, there must be a high degree of public supervision of construction and operation during the

development period. There should also be sufficient public supervision of private enterprise to prevent misrepresentation or fraud in the sale of both securities and land. The chances of financial success of both public and private enterprises will be improved by making the preparation of land for immediate use a part of reclamation work and by providing capital for improvements and equipment. All these involve a high degree of supervision of agricultural operations until repayment of advances has progressed sufficiently to make the security for the balance ample.

Land settlement (*California Sta. Rpt. 1923, pp. 226-229, figs. 2*).—Some of the points brought out by the study of the records of financial transactions by each settler on the Durham and Delhi State land settlements in California are reviewed. The settlements are said to have demonstrated the State's opportunity of making rural life more attractive, and results in the Delhi colony show the economic loss which the State has sustained by delay in bringing the land under irrigation. Investigations have also been carried on with reference to land settlement in the principal irrigation districts of the State.

Report of the committee on land purchase in Northern Ireland, E. PERCY ET AL. (*London: [Gt. Brit. Treasury], 1923, pp. 21*).—A committee, appointed by the Chancellor of the Exchequer in June, 1923, to consider what should be the terms of future land purchase in Northern Ireland and to make recommendations for legislation accordingly, makes its report in these pages. The claims and contentions of landlords and tenants were considered.

The committee recommends that payment be made in 4.5 per cent stock redeemable by periodical drawings with a sinking fund of 5s. per cent, the percentage of rent payable by the purchaser as annuity and the amount of bonus per £100 rental remaining unchanged. Previous schemes granting a bonus to the landlord personally as an inducement to sell are favored, and on the question of encumbered estates it appears to be generally agreed that mortgages at any rate must be paid off in cash, while the head rents and family charges should be payable in stock. The recommendations embodied in the report of a subcommittee on land purchase, submitted in January, 1918, are upheld in general in this later report.

Recent colonization in Chile, M. JEFFERSON (*Amer. Geogr. Soc., Research Ser. No. 6 (1921), pp. [2]+52, pls. 8, figs. 5*).—The author traces the establishment of certain colonies in Chile, principally by settlers of German extraction.

Group settlement in western Australia, H. P. COLEBATCH (*United Empire [Roy. Colon. Inst.], n. ser., 15 (1924), No. 3, pp. 166-179*).—A brief account is given of the provisions for and efforts toward colonization on farms in western Australia.

A history of land tenure in England, J. GHOSH (*Calcutta: Kar, Majumder & Co., 1922, pp. [6]+280*).—Four chapters dealing, respectively, with communism, feudalism, customary tenancy and money economy, and modern landlordism and capitalist farming comprise this review.

Successful farming on eighty-acre farms in central Indiana, H. W. HAWTHORNE and L. ROBERTSON (*U. S. Dept. Agr., Farmers' Bul. 1421 (1924), pp. II+22, figs. 17*).—About 340 records from farms of approximately 80 acres in central Indiana have been obtained in the course of a study carried on since 1910 by the extension service of the Purdue University and the Department. In general, these records show that on an average over a period of years operators of farms of this size make about a mortgage rate of interest on their capital and something near a hired man's wages for their labor, in addition to securing the products furnished by the farm for the family living and a possible increase in value of the farm land owned.

Cropping systems, crop yields, farm layouts, livestock production, labor, work animals, equipment, and family living are discussed here on the basis of results from all the 80-acre farms in Indiana from which records have been taken. These points are illustrated with facts from the four most successful and the four least successful of 20 farms in Clinton County through eight years, 1910 to 1919. The most successful 80-acre farmer in the Clinton County group received an average farm income of \$1,722 per year for eight years as compared with \$196 per year received by the least successful farmer. In general, the more successful farmers had definite crop rotation systems of corn, small grain, and clover and timothy, with a tendency to put more land in corn whenever practicable. Over a series of years yields as high as 50 bu. of corn, 45 bu. of oats, 20 bu. of wheat, and 1.5 tons of hay per acre were obtained. From 3 to 5 dairy cows with enough young cattle to maintain the herd, from 5 to 8 brood sows raising from 50 to 70 pigs per year, 100 or more hens, and 3 work animals were common.

A table is given showing standards of organization and management for successful farming on 80-acre farms under 3-, 4-, and 5-year crop rotation systems.

Twenty years' profits from an apple orchard, U. P. HEDRICK (*New York State Sta. Bul. 510* (1924), pp. 4-14, figs. 2).—Data are submitted showing the costs and returns for an orchard west of Rochester, N. Y. The trees are Baldwins, now 47 years old. The data are given for the barrel, the tree, and the acre, and comparisons are made between returns for two 10-year periods, 1904-1913 and 1914-1923, in continuation of an earlier study (E. S. R., 31, p. 46). The average yield per acre in the first period was 116.8 bbls., in the second 119.99 bbls. The annual cost of tillage per acre for the first decade was \$7.39, while the amount charged against each barrel was 6.6 cts. For the second decade the cost per acre was \$14.40, that per barrel 11.7 cts.

The average yearly net profit on a barrel of apples, graded and ungraded, for the period 1903-1913 was \$1.31, and for the second period \$1.71. The average net profit per acre for the first period was \$95.60, and for the second \$145.83. On land valued at \$500 per acre a little over 24 per cent was yielded as the annual 10-year dividend for this orchard; for the second decade the annual dividend was 28.5 per cent.

Poultry accounts, A. R. LEE and S. HAYNES (*U. S. Dept. Agr., Farmers' Bul. 1427* (1924), pp. II+6).—This is a revision of B. A. I. Circular 176, previously noted (E. S. R., 25, p. 375).

United States grades for timothy hay, clover hay, clover mixed hay, and grass mixed hay, E. C. PARKER (*U. S. Dept. Agr., Dept. Circ. 326* (1924), pp. 24, figs. 2).—The investigational work preliminary to the formulation of these grades, hearings, training of inspectors, and other activities are related. United States grades for timothy and clover hay are described, and suggestions are offered with reference to haymaking, baling, and loading methods essential to the marketing of high-grade hay. Descriptions of each class and grade in the official grades for timothy, clover, clover mixed, and grass mixed hays are presented.

Marketing (*California Sta. Rpt. 1923*, pp. 229-232, fig. 1).—A study was made by H. E. Erdman of the marketing of sweet potatoes, cantaloupes, and watermelons in central California and of white potatoes in various parts of the State. A chart is presented illustrating the heavy shipments of sweet potatoes in the months of September to January, inclusive, and the corresponding low prices at that time. More orderly marketing and adequate storing facilities are recommended. The cooperative marketing of annual crops, such as sweet and white potatoes, was found to have been much less success-

ful in this State than that of fruit crops. One of the most serious of the difficulties arises out of the instability of the producers, or their tendency to shift from crop to crop.

Cooperative marketing of fruits, livestock, and grain in the United States (*U. S. Dept. Labor, Bur. Labor Statis., Mo. Labor Rev., 18 (1924), No. 6, pp. 169, 170*).—A summary is given of statistics pertaining to 1923, with comparisons as compiled from the preliminary reports of the Bureau of Agricultural Economics, U. S. D. A.

Cooperative central marketing organization, J. D. BLACK and H. B. PRICE (*Minnesota Sta. Bul. 211 (1924), pp. 112, figs. 3*).—This is an interpretation in terms of Minnesota conditions of cooperative central marketing as at present developed. There are listed 16 problems which local cooperatives acting alone have thus far been unable to solve satisfactorily. Several important organizations are described as illustrating the different degrees of centralization and integration to be found in the United States, and the principal differences between these and federated organizations are pointed out. Organization and management problems are then discussed, these including pooling, controlling the time of movement to market, the monopoly problem, control of distribution of the product, control of quality, disposing of surplus crops, selling, integration, the status of locals, the membership contract, financing, nonmember business, and improving the organization and management of the locals. Certain important differences between the two acts under which cooperatives may organize in Minnesota are summarized.

Operating methods and expense of cooperative citrus-fruit marketing agencies, A. W. MCKAY and W. M. STEVENS (*U. S. Dept. Agr. Bul. 1261 (1924), pp. 35, figs. 10*).—By way of introduction a short sketch is given of the organization of the California Fruit Growers Exchange system, together with information on harvesting operations and expenses. Packing house operation and expenses of a cooperative association with a membership of from 50 to 200 growers of oranges and lemons are discussed in detail.

Detailed statements of packing-house expense per box of oranges and lemons by associations are presented. Average expenses, increases, and variations are discussed. Growers' average net receipts are shown to have amounted to \$1.58 and \$2.58 per packed box of oranges and lemons, respectively, in 1917, \$3.87 and \$4.26 in 1918, \$3.06 and \$2.97 in 1919, \$3.32 and \$1.73 in 1920, and \$1.92 and \$2.67 in 1921. Packing-house expense over the 5-year period averaged one-sixth of the sale price of oranges and less than one-fourth of the sale price of lemons. It is to be noted that in 1920 and 1921 packing-house expense tended to become more nearly equal to the growers' receipts. In 1921 the lowest average growers' receipts for oranges were a little less than the highest packing-house expense. Packing-house expense, therefore, is becoming an increasingly important item, and its relation to the growers' receipts a matter for careful consideration.

Expenses of distribution are discussed under the heads of district exchange expense, that of the central exchange and of transportation, and wholesale and retail margins. As an average for the 5-year period, 52 per cent of the total price paid for oranges by the consumer and 56 per cent of the price paid for lemons are absorbed by the transportation, wholesaling, and retailing agencies.

Cooperative dairy marketing plans, T. MACKLIN (*Wisconsin Sta. Bul. 367 (1924), pp. 24, figs. 6*).—Commodity marketing, or selling through cooperative organizations founded on a single main interest, is described here. The organization of local bodies and their federation are outlined and illustrated with examples of organizations now operating in Wisconsin. A combined general

dairy marketing plan providing for five forms of local cooperative organization and three federations of locals to render central selling service for a specific finished article is outlined. In addition, private condensing plants and condensed milk sales organizations are indicated, as well as private city milk distributors.

The plans presented are an outgrowth of joint investigations and research by the American Farm Bureau Federation and the Wisconsin College of Agriculture.

Farmers' Market Bulletin, [September, 1924] (*North Carolina Sta., Farmers' Market Bul.*, 11 (1924), No. 71, pp. 11).—United States grades for barreled apples are described, and an account is given of a farmers' marketing organization in Buncombe and Henderson Counties, N. C., together with the usual list of products which farmers have for sale.

The agrarian revolution in Roumania, I. L. EVANS (*Cambridge, Eng.: Univ. Press*, 1924, pp. XVI+197, pl. 1, fig. 1).—Attention is directed to the historical evolution of the agrarian problem in the old kingdom and in the territories which are now united in the modern Kingdom of Rumania. Geographic and economic phases of the agrarian history of each of the important political divisions are discussed. Chapters are given further to agrarian conditions on the eve of reform, the new agrarian laws and their application, agricultural production since the war, economic and general consequences of the reform, and the historical perspective. A special statistical appendix is included.

The general consequences of the reform from the point of view of production are considered to have been fairly satisfactory over the short period under review. A survey of the facts of production since 1919 does not appear to justify the assertion that agricultural productivity has been reduced. On the other hand, it is deemed reasonably certain that the reduction in the cultivated area in Rumania since the war would have been much greater but for the salutary psychological effects of the new legislation on the rural population.

Agriculture and the guild system (*London: Natl. Guilds League*, 1923, pp. 24, pl. 1).—A scheme is outlined here which would secure a limitation of the rights of private owners over the land in Great Britain by putting the control into the hands of elected land councils in each parish. County and national federations are suggested, and cooperation is advocated as a means of stabilizing prices. A preface on rural policy and a historical introduction are written by M. Fordham.

[Report of the] **advisory agricultural committee, Geneva**.—First session, 22-24 August, 1923 (*Geneva: Internatl. Labor Off.*, 1923, pp. 66).—An advisory agricultural committee, set up in consequence of an agreement arrived at between the International Labour Office and the International Institute of Agriculture, met at Geneva, August 22, 1923, to discuss the agenda, which included the questions of the vocational education of agricultural workers, workers' cooperation in agriculture, and the prevention of anthrax infection in flocks. Questionnaires which were drawn up are submitted here, and notes prepared by the International Labour Office on the three items are presented, together with minutes of the meetings of the committee and of other allied bodies.

Rural social problems, C. J. GALPIN (*New York and London: Century Co.*, 1924, pp. [7]+286).—This is a discussion of the human element in agriculture and country life. It is composed of 17 chapters each discussing one of such topics as the contributing factors to a distinct rural psychology, the farmers' standard of living, the farm women's problems, trade centers, tenancy, agricul-

ture and modern institutions in the country, the advantages and disadvantages of farm life, the movement of population to and from farms in the United States, rural life in American art, and the hope for the future.

Agricultural cooperation in Denmark, C. L. CHRISTENSEN (*U. S. Dept. Agr. Bul. 1266 (1924), pp. 88, figs. 22*).—These pages set forth in considerable detail historical information and important features of the present operation of cooperative societies in Denmark for the production of dairy products, bacon, and eggs; cooperative cattle export associations; buying and credit societies; cooperative breeding associations; and miscellaneous organizations. Statistics are incorporated and numerous photographic illustrations are included.

Impressions of the co-operative movement in France and Italy, O. ROTH-FELD (*Bombay: Govt., 1924, 2. enl. ed., pp. 111*).—Systems of agricultural cooperation in France and Italy are reviewed, and recent developments are recounted, the principal aim being to point out lessons therefrom for the attention of cooperators in India.

Co-operative movement in Russia, E. T. BLANC (*New York: Macmillan Co., 1924, pp. XI+324*).—The leadership of the intelligentsia in the nineteenth century in the overthrow of remnants of the feudal system, the launching by elective administration units known as Zemstvos of the cooperative movement with specific reference to agricultural and producers' cooperation, and other phases of the beginnings of the cooperative movement in Russia are set forth. The effect of the World War, the growth of centralization between 1917 and 1919, and the developments under the Bolshevik régime are also treated in detail. The Russian cooperative movement is said to be tending at the present time to become a powerful economic factor in the national life. International relations are described, together with the educational significance of the movement.

Statistical annual of the Republic of Chile.—VII, Agriculture, 1921–22 [trans. title] (*An. Estadís. Chile, 1921–22, Sect. VII, pp. [4]+140*).—Statistics of agriculture for the current year are presented, continuing the series previously noted (*E. S. R., 50, p. 393*).

[Statistics of land settlement, agriculture, and pastoral pursuits for Australia, 1911–12 to 1921–22] (*Aust. Bur. Census and Statis., Prod. Bul. 16 (1923), pp. 9–77*).—Statistics for the later years are tabulated along lines previously noted (*E. S. R., 48, p. 495*).

Estimates of area and yield of principal crops in India, 1921–22, D. N. GHOSH (*India Com. Intel. Dept., Est. Area and Yield Princ. Crops India, 1921–22, pp. [2]+43, pl. 1*).—Tabulated statistics continue the series of reports previously noted (*E. S. R., 47, p. 395*).

Live stock and animal products statistics, 1922, F. J. HORNING (*Canada Bur. Statis., Livestock and Anim. Prod. Statis., 1922, pp. 122, figs. 6*).—This report presents statistics covering the period 1909–1922, succeeding one noted earlier (*E. S. R., 49, p. 491*).

AGRICULTURAL EDUCATION

List of workers in subjects pertaining to agriculture.—Part 2, State agricultural colleges and experiment stations, 1923–1924 (*U. S. Dept. Agr., Misc. Circ. 17 (1924), pp. V+103*).—This list, compiled by M. A. Agnew and B. T. Richardson, shows the members of the faculty and staff of the State agricultural colleges and experiment stations who are engaged in agricultural teaching, investigation, or demonstration.

Annual report of the director of agricultural extension, B. H. CROCHERON (*California Sta. Rpt. 1923*, pp. 315-464, figs. 56).—General activities and the results of extension work in California for 1922-23 are reported upon along the main lines of soil improvement, crop production, orchard and vineyard crops, rodent and pest control, livestock production, farm and home economics, agricultural clubs, public service, and correspondence courses in agriculture, certain phases of which have been noted elsewhere in this number.

Features of the Arkansas plan in vocational agriculture, E. B. MATTHEW (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 908, 909).—A policy of reimbursement is described by which the amount of money any school may receive is proportionate to the number of farm students enrolled. The schools in the State are classified, and reimbursement is given in direct proportion to the farming population represented.

The minimum financial goal in vocational agriculture in Mississippi, F. J. HUBBARD (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 903-905).—This sets forth the value of a standard for departments and teachers of agriculture, whereby they endeavor to make the total net profit from pupil projects not less than the total cost of their agricultural instruction for the fiscal year on the basis of teachers' salaries.

The pioneer manual labor schools, C. P. COATES (*Indus. Arts Mag.*, 13 (1924), No. 9, pp. 323-327, fig. 1).—Early missionary efforts in North America toward the founding of schools for the trades and the history of the founding of the Pioneer Manual Labor School near Charleston, S. C., by J. de la Howe are recounted. The complete plan, known as the Columbian plan, which appeared in print in 1787 and on which De la Howe based his directions in endowing the school, is given.

Agricultural education and research in Denmark, A. M'CALLUM (*Scot. Jour. Agr.*, 7 (1924), No. 2, pp. 161-170).—Elementary and secondary schools and the proprietary folk high schools, as well as higher institutions and laboratories and other facilities for research and control, are briefly described.

Agriculture: The science and practice of British farming, J. A. S. WATSON and J. A. MORE (*Edinburgh: Oliver and Boyd, 1924*, pp. X+656, pls. 33, figs. 59).—This book is primarily intended for the use of students in courses of agriculture in universities, colleges, and farm institutes. The subject matter is presented in four main sections, dealing with the soil and its management, crops, livestock, and farm organization and management.

Junior projects in outlying rural schools, W. J. GREEN (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 905, 906).—A brief description is given of a plan followed in a certain community in Oklahoma by organizing clubs in rural schools under the general supervision of the vocational agriculture department of a neighboring high school.

A class project in poultry husbandry, R. E. BRUNER (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 906-908).—Some of the individual and community benefits of a poultry project are set forth.

Type instruction sheets in home economics, E. A. FARNSWORTH (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 936-943).—Lesson plans which have been tried out in two terms of the continuation school at Staten Island, N. Y., are submitted here. Sheets are prepared for hygiene and nutrition, home nursing, the preparation of meals, child care, and home furnishing.

Nutrition clinic as a project in part-time continuation school, M. OTTE-SON (*Vocat. Ed. Mag.*, 2 (1924), No. 11, pp. 924, 925).—This is an account of a problem given to part-time school girls. The underweight pupils in the building in which the school was located were taken into a nutrition class, and

their gains were carefully recorded. Methods of carrying on the health campaign are described.

Posters prepared by school children in milk-for-health programs, J. M. HOOVER (*U. S. Dept. Agr., Misc. Circ. 21* (1924), pp. 8, figs. 5).—Prize-winning posters designed by children in both city and rural schools are reproduced. Suggestions are offered to milk-poster committees, and certain points to be taken into consideration when judging posters are noted.

Motion pictures of the United States Department of Agriculture (*U. S. Dept. Agr., Misc. Circ. 27* (1924), pp. 32).—This is a list prepared in the Office of Motion Pictures of the Extension Service of films available through county extension agents and workers in related fields to persons and agencies interested in the work of the Department. Directions are given for obtaining them.

MISCELLANEOUS

List of bulletins of the agricultural experiment stations for the calendar years 1921 and 1922, C. E. PENNINGTON (*U. S. Dept. Agr. Bul. 1199* (1924), *Sup. 1*, pp. 24).—This supplements the list previously noted (*E. S. R.*, 51, p. 495).

Report of the College of Agriculture and the Agricultural Experiment Station of the University of California, July 1, 1922, to June 30, 1923, T. F. HUNT, C. M. HARING, ET AL. (*California Sta. Rpt. 1923*, pp. [4]+476, pls. 2, figs. 177).—This volume includes a report of the dean of the College of Agriculture (pp. 7-48), an account of the achievements of the college and station for the fiscal year ended June 30, 1923 (pp. 49-263), and reports of the director of the station (pp. 264-308), the acting director of resident instruction (pp. 309-314), and the director of agricultural extension (pp. 315-464). The experimental work reported is for the most part abstracted elsewhere in this issue. The report of the director of the station includes a list of the station projects and publications.

The Quarterly Bulletin [of the Michigan Station], edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 1, pp. 38, figs. 12).—In addition to articles abstracted elsewhere in this issue, this number contains one entitled Fall Inoculation of Vetch, by R. M. Snyder.

Bi-monthly Bulletin [of the Western Washington Station] (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 3, pp. 53-76, figs. 8).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Culture of Vetch as a Fall Sown Crop, by M. E. McCollam; Sour Cherry Growing in Western Washington, by H. D. Locklin; and Red Water or Bloody Urine in Cattle, by J. W. Kalkus, reprinted from a previous issue (*E. S. R.*, 38, p. 486).

NOTES

Arkansas University.—Recent changes in buildings and equipment include connections with the city water works and fire protection service at a cost of \$6,000, tiling and drainage work costing \$3,600, fencing \$1,200, six new cottages for employees \$6,000, a new hay and work stock barn \$3,500, two 6-unit garages \$800, 100 acres of additional land, and a general repainting and landscape improvement.

Illinois University and Station.—Dr. Robert Graham, chief of the animal pathology and hygiene divisions, has been given a year's leave of absence to organize animal disease control work in Haiti and to study tropical diseases of livestock and their control. Dr. C. L. Stewart, of the Bureau of Agricultural Economics, U. S. D. A., has been appointed in charge of the work in agricultural economics in the College of Commerce of the university. Benjamin Koehler has been appointed associate in crop pathology, Floyd F. Elliot associate in farm organization and management, Ernest P. Lewis associate in olericulture, and Merl C. Gillis and Lloyd A. Koritz research assistants in olericulture.

Purdue University and Station.—A new experimental greenhouse costing \$12,000 has been completed for use in experimental work in soils and crops and horticulture. The addition of this equipment also makes possible an expansion of the experimental work in pathology, physiology, and entomology.

A house and laboratory costing \$6,000 has been completed for the nutrition experimental work and the breeding and care of white rats and guinea pigs. A hog barn has been constructed on the Livestock Experimental Farm at a cost of \$5,500. This barn will provide farrowing quarters for the brood sows used in the swine projects, storage for feeds, scales, etc., and rooms for the attendants.

The Junior Champion Red Polled Bull at the 1924 International Livestock Exposition was purchased by the station to head the herd at the Pinney-Purdue Farm. A prize-winning heifer was also included in the purchase.

An agricultural conference for farmers and their wives, held from January 12 to 16, replaced the one-week farmers' short course, which has been held for about 25 years. The annual conference of extension workers took place at the same time.

M. O. Pence, for the past seven years county agent leader and extension agronomist at the Delaware University, has been appointed associate in soils and crops extension work, vice R. S. Thomas, resigned.

Iowa College and Station.—Contracts have been let for a new home economics building to cost about \$600,000. This will be constructed of stone to match the main buildings of the campus and will incorporate as one wing the present home economics building, which will be faced with stone. This new building will make it possible for the home economics work to be taken out of the many wooden structures that the college was obliged to provide to accommodate the rapidly growing enrollment of women in home economics courses.

A new livestock judging pavillion, 100 by 56 ft. and costing \$20,000, is nearing completion. It is divided into two sections, one of which will provide a class-

room for livestock management as well as judging groups. It is part of a group of new animal husbandry buildings of brick and tile which are replacing older structures, some of them wooden. Already completed and occupied are the meat demonstration laboratory, a swine judging pavillion and model swine barn, a horse barn, and a sheep barn, and a cattle barn will soon be added.

Merritt Greene '05 has been appointed to the State Board of Education to fill the vacancy caused by the death of Charles R. Brenton. Mr. Greene is the first graduate of the college to hold a place on this board, which is the board of control for all State institutions for higher education in Iowa.

New agricultural economics courses are being offered in transportation and railway traffic and rates. H. C. Frame has been appointed assistant professor and assistant in agricultural economics and will have charge of these courses and, in addition, those in rural, business, and veterinary law, formerly handled by E. A. Hilker, resigned. W. A. Youngman, assistant in agricultural economics and farm management in the station, has resigned to become associate professor of agricultural economics in the Texas College and has been succeeded by Millard Peck. Dr. A. W. Hayes of the department of sociology of Tulane University has accepted an appointment as associate professor in rural sociology, beginning January 1.

New forestry courses are being offered in forest conservation and commercial woods.

Kansas College.—What is believed to be the first short course in beef cattle herdsmanship was offered during the holidays.

Michigan Station.—A recent development by the botanical section of the station is a strain of the Golden Self-blanching variety of celery which is highly resistant to the yellows disease. The first selections of this seed are grown in disease infected soil in the Michigan celery district near Kalamazoo. The seed is then increased in cooperation with the U. S. Department of Agriculture at Chula Vista, Calif. The first distribution of this seed is to be made in 1925 and is to be handled through the Grand Rapids Celery Growers Association.

Considerable success has been attained by the bacteriological section in its work with infectious abortion in cattle. Recent work using a nonvirulent living culture of *Bacterium abortus* in the protective vaccination of cattle against bovine infectious abortion has shown very satisfactory results in the immunizing of cattle which are not already infected with the disease. Over 500 head of cattle have been treated with the nonvirulent living cultures.

Minnesota University.—The new dairy building, previously described (E. S. R., 50, p. 397), was dedicated on January 1 in the presence of the farmers and home makers in attendance at the annual short course. It has been named Haecker Hall in honor of T. L. Haecker, who was in charge of dairy research and instruction from 1891 to 1918. Professor Haecker was present at the exercises and recounted some of his earlier experiences and difficulties in initiating the cooperative creamery movement and in establishing dairying on the farms of Minnesota. The dedicatory address was made by A. J. Glover, editor of *Hoard's Dairyman* and a former graduate of the College of Agriculture. He pointed out the great influence of Professor Haecker in promoting dairy production in the early days of the industry and emphasized its present importance in Minnesota, stating that the value of the dairy production of the State had increased from \$15,000,000 in 1891 to \$230,000,000 in 1923.

Rutgers College.—The enrollment in the short courses, which opened on November 17, 1924, was 60, of whom 18 were in the fruit growing, 30 in the poultry, and 12 in the general and dairy farming group.

New Hampshire University and Station.—T. G. Phillips, professor of agricultural chemistry in Ohio State University, has been appointed head of the department of agricultural chemistry in the university and chemist in the station vice Dr. H. R. Kraybill, whose resignation has been previously noted. Doctor Phillips began his new duties January 1, but will return to Ohio during the spring term to complete work under way at that institution.

Cornell University.—Plans for the new plant industry building, authorized by the legislature in 1922, are being revised by members of the departments concerned in conference with the university grounds committee. The building will involve an expenditure of nearly \$500,000.

Sabbatical leaves have been granted Dr. Paul Work of the vegetable gardening department and H. H. Love of the plant breeding department.

Clemson College.—Dr. E. W. Sikes, president of Coker College for Women, has been appointed president.

Hampton Institute.—Charles K. Graham, director of the agricultural department from 1908 until his retirement in 1919 because of ill health, died November 1, 1924, at the age of 46 years. Professor Graham was a native of Ontario and served for a year as instructor in poultry husbandry at the Ontario Agricultural College. From 1905 to 1908 he was associated with the poultry work of the Connecticut Storrs College and Station.

Report of Scottish Committee on Agricultural and Research Education.—In February, 1924, the Secretary for Scotland appointed a departmental committee to consider and advise regarding the general organization and support of agricultural education and research in Scotland. An inquiry into the existing status was made, with comparisons with systems prevailing in the colonies and in foreign countries, and a report has now been issued.

It is concluded that the supervision of the agricultural colleges should remain in the Board of Agriculture, and that close relations should be maintained with the universities. More emphasis upon agricultural economics and farm management and greater attention to the requirements of prospective farmers were recommended.

The all-round general development of agricultural research in Scotland is urgently stressed. The strengthening of the Institute for Research in Animal Diseases and the Plant Breeding Station is urged, as well as the establishment of a research institute in connection with the National Dairy School at Kilmarnock and the provision of an experimental and demonstration farm at the Rowett Research Institute, the institution of special research in plant pests and diseases, and the systematic recording and analysis of cost data. It is believed that the possibility of raising special funds for agricultural research should be more fully examined and that, in particular, careful consideration should be given to the imposing of a limited tax on agricultural land.

Pacific Radio-telegraphic Weather Reports.—The Pan-Pacific Food Conservation Conference, recently held at Honolulu, recognizing that "for the preparation of forecasts and warnings of adverse weather conditions it is essential that weather reports be received by radio-telegraph from as many ships at sea as possible," recommended "to the various Pacific nations that all ships, while at sea, transmit regular observations of the weather by radio-telegraph to those national agencies already established for the purpose of issuing forecasts of the weather and warnings of storms." At the same conference, Kao Lou, director of the Chinese Central Observatory at Peking, submitted for this purpose a uniform code of signals for the Pacific.

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The annual convocation under the auspices of the American Association for the Advancement of Science has come to occupy a unique and important place in the calendar of research workers in agriculture. It furnishes a meeting ground where the entomologist, the horticulturist, and the geneticist, for example, may commingle both with their colleagues and those who are delving in fields of inquiry less closely related. Organized, as its title states, for the advancement of science, the association provides a congenial atmosphere for the interchange of ideas and the renewing of ideals.

At the latest of these gatherings, held in Washington from December 29, 1924, to January 3, 1925, these and other important advantages were quite fully realized. It was the seventy-ninth annual meeting of the association, and it far surpassed in attendance any of its predecessors. The total registration was 4,206, a figure 74 per cent above the previous high mark of 2,413 and nearly double that of the meeting at Cincinnati in 1923. Indeed, it is thought to have been the largest assemblage of scientific men and women that has ever been brought together in any country. The attendance was also well distributed among the 15 sections and 35 associated societies represented, quite commonly taxing the capacity of the accommodations provided for the various sessions and other activities.

The broad national significance of the meetings found formal recognition in the reception of the members by the President of the United States and the participation of the Secretary of State in the opening session of the association. In his address of welcome, President Coolidge referred to the interest of the Government in scientific activity, stating that in comparison with other agencies it has been "foremost in employing and most liberal in endowing science." Addressing the members, he declared that they represented "the interests, the forces, and the endless activities which literally from day to day are conquering new domains and adding them to the imperial realm of human knowledge," with the result that, as he said to them, "the future of civilization is in your hands." A similar idea was expressed by Secretary Hughes when he referred to science

as "the aristocracy of effort without which democracy would be arid and fruitless," and its workers as holding "the promise of additions to the resources of humanity, the staking out of new possessions in the unseen world; of fresh discoveries and a richer life."

The address of Secretary Hughes dealt mainly with the advantages of cooperation, pointing out that scientific achievement is not individualistic but is the work of groups either consciously formed or produced by the essential correlation of effort. Such cooperation, he maintained, is of necessity international in its scope. "We should think in terms of the cooperation of peoples and not simply of governments. Science knows no political boundaries; she recruits her conquering chieftains from all climes and races. It may be an Austrian monk, revealing the secrets of plant inheritance; or a New Hampshire farmer's boy who learns to fashion instruments of the utmost delicacy and precision; or a Serbian herdsman taking youthful lessons in communication by listening through the ground; or a Japanese devotee of medical research isolating and cultivating micro-organisms. In this field all are coworkers, and pride is not of race or of tradition, but of achievement in the interest of humanity."

The Washington meeting had a special interest for agriculture in that it constituted the tenth anniversary of the establishment within the association of a section on agriculture. It seems evident that in the decade which has elapsed its creation has been on the whole amply justified. Section O has very logically become a sort of nucleus for the many societies built up around the central theme of agricultural advancement through the aid of science, and it has helped to unify and to integrate the forces working in that direction.

The program of Section O included three joint sessions and an evening dinner. The joint sessions were held in turn with the Geneticists Interested in Agriculture, the American Society for Horticultural Science, and the American Society of Agronomy, and the dinner was in conjunction with these societies, the Potato Association of America, the Association of Official Seed Analysts, and the Society of American Foresters.

The section meetings were presided over by the vice president and chairman, Dr. L. R. Jones of the University of Wisconsin. The incoming vice president was announced as Dr. C. V. Piper of the Bureau of Plant Industry, while Director S. B. Haskell of the Massachusetts Experiment Station was elected for a four-year term on the section committee.

The retiring vice president of the section, President R. A. Pearson of Iowa, was unable to be present, but his address was duly presented. Its title was Better Adapting Our Educational and Investigational Efforts to the Agricultural Situation, and its author, as in his presidential address before the Association of Land-Grant Col-

leges in November, set forth the need of a comprehensive survey of the educational and research field as at present organized, with a view to suggesting such redirection of effort as may seem desirable. Agriculture, he pointed out, in this country is now entering upon a new epoch, the five essentials for success in which he enumerated as careful business methods, maintenance of fertility, good homes and surroundings, fair legislation, and patriotic citizenship. Increased aid for research he regarded as an outstanding need under the conditions prevailing to-day.

The joint meetings with the agricultural geneticists and the agronomists constituted the entire program for these groups, while that with the horticulturists occupied only one session of a three-day program. The geneticists presented two papers on plant and animal judging in relation to genetics, one dealing with corn and the other with dairy cattle. The meeting in conjunction with the agronomists took the form of a symposium on agricultural conditions in foreign lands, with papers on Great Britain, Germany, India, Central and South America, and East Africa. The gratifying attendance at this session, despite a direct conflict with a similar symposium of the Association of American Geographers on problems of the Tropics, indicated the rapidly increasing interest since the war in what used to be looked upon as far away regions of limited concern to this country. The geographers devoted a full day to conditions in the Tropics, most of their papers dealing quite closely with the potentialities of this region as a source of the world's food supply. The programs of the two bodies included no fewer than seven reports by representatives of the U. S. Department of Agriculture alone which were based on their recent personal observations abroad, indicating how widely the interests of the department are expanding beyond our borders.

The American Society for Horticultural Science held one of the most successful of its 21 annual meetings, with a large attendance and a program comprising about 85 papers, of which nearly 75 were contributed from the State experiment stations. The subjects covered nearly every phase of horticulture and included sectional sessions on pomology, vegetables, and extension work. The joint session with Section O dealt mainly with teaching problems but concluded with several notably appreciative and constructive addresses on methods and ideals in research. The evident interest with which these addresses were received was most encouraging, and indicated a deepening conviction that horticultural research of a fundamental type is still greatly needed, that for the solution of the outstanding problems the service of the botanist and the chemist as well as the horticulturist must be enlisted and retained, and that the most important requisite is not so much elaborate equipment or

superrefinements of method as the cultivation of the research spirit and the adequate preparation and development of the investigator himself.

The botanists and the entomologists presented their customary elaborate programs. Here also the influence of the experiment stations was much in evidence. These institutions contributed over 40 of the 57 papers to the American Phytopathological Society, a goodly proportion, as would be expected, to the American Association of Economic Entomologists, and numerous papers to the other botanical and entomological bodies.

Interest from the viewpoint of agriculture was by no means confined to individual societies or sections bearing one of its distinctive labels. One of the principal advantages of the American Association gatherings is well understood to be the opportunity for contacts in a wide range of fields, and for this the Washington meetings were conspicuous. An attempt was made in the general program to indicate the main cross currents of interest, but it is quite certain that the lists would have had to be extended much farther to attain completeness, as the primary difficulty confronting the would-be auditor was one of constant selection.

So wide was the range of material as to preclude in these columns even a mere listing of the papers related to agriculture. Mention should be made, however, of the symposium on the physiological effects of light at a joint session of the American Society of Plant Physiologists and the American Physiological Society, at which the striking effects of ultraviolet radiation were set forth, especially in their relations to growth in plants and animals. Similar papers were presented to the American Society of Biological Chemists, as well as others discussing recent developments as regards vitamins, mineral metabolism, and related problems. Two papers before the American Meteorological Society dealt with the weather in relation to the production and harvesting of fruit and other crops, and a paper in Section C, chemistry, on the preparation of levulose from dahlias, indicated possibilities of important new sources of this sugar on a commercial scale. The presidential address before the Association of American Geographers was entitled *The Promulgation, Decline, and Renaissance of Malthusianism and Its Relation to the Character and Geographic Distribution of the Soil*, by the head of the Soil Survey of the U. S. Department of Agriculture. There was also the joint genetics session of the American Society of Zoology and the Botanical Society of America, with some 50 papers; two sessions of the Society of American Bacteriologists with about 30 papers on agricultural and industrial bacteriology; and the comprehensive three-day programs of the Potato Association of America and the Association of Official Seed Analysts.

Taken collectively, the total number of papers of agricultural interest in all these various lines approximated fully 600. When it is remembered that at the time of the last Washington meeting in 1911 the total number in all subjects was less than 1,000, the development of interest in agricultural research in recent years appears quite significant and gratifying. Reflecting as it does the growing number of workers and the marked advance in the grade of research as well, it indicates a condition which is both fortunate and encouraging.

During the last few months the U. S. Department of Agriculture and many of the agricultural colleges and other institutions in this country have had the privilege of welcoming an unusual number of the best known workers in agricultural science in England. The holding in Toronto of the 1924 meeting of the British Association for the Advancement of Science was the immediate occasion for the presence of a large delegation of distinguished British scientists in Canada, not a few of whom subsequently included the United States in their travels. Among this group may be mentioned Sir John Russell, director of the Rothamsted Experimental Station and the president of the section on agriculture; Lord Bledisloe, chairman of the Lawes Agricultural Trust (Rothamsted) and also of the committee for agricultural research of Bristol University; Drs. H. J. Page, chemist, and D. Ward Cutler, protozoologist at Rothamsted; Drs. Otto Stapf and T. F. Chipp of the Royal Botanic Gardens, Kew, R. B. Forrester, marketing commissioner of the Ministry of Agriculture and Fisheries; and Dr. V. H. Blackman, professor of plant physiology and pathology in the Imperial College of Science and Technology of London. Of this number Sir John Russell and Drs. Page, Cutler, and Blackman delivered lectures on subjects related to their immediate fields before the department's staff and others, which were greatly appreciated.

More recently Sir Daniel Hall, chief scientific adviser to the Ministry of Agriculture and Fisheries and widely known for his eminent services at Wye and Rothamsted and as a leader of agricultural development in Great Britain, spent some time in Washington in connection with a study which he is making in this country of agricultural methods and the agricultural situation in general. During his stay he addressed a large company of the department's staff on the subject of Agricultural Research and the Community, and subsequently at a dinner which was tendered him he described in considerable detail the existing system of agricultural education and research in England and Wales.

The first of these two addresses, given under the auspices of the graduate school of the department, is regarded as a very notable contribution. It told in an inimitably attractive and convincing way

of the peculiar characteristics of research, the conditions under which it is most effective, and what the State can do to stimulate and encourage its development.

Sir Daniel pointed out quite forcibly that there are certain limitations to the effect of science on agriculture which do not prevail in other industries. These are due to the fact that agriculture is a living organism, dealing with living things, which makes the amount of control man has assumed relatively smaller than that over inanimate objects. Nature will follow its course through the cycle and can not be hurried. It takes a certain number of months to mature a crop of wheat, and "the time of calving has not been reduced since the Roman Empire." We can not hope, therefore, for the revolutionary changes in agriculture that have marked such things as aviation and radio.

At the same time he considered that agriculture is suffering from the march of science in other industries, stating that we can not point to any part of the world and say that the men engaged in it are in a flourishing condition. The rewards are not commensurate with those in industry and commerce. As a result people and capital are both being diverted from the farm. The lure of the town is not new, but modern communication has increased its range of action. There must be a limit to this movement; the people must be fed. The steady rise of price of agricultural products is some evidence that we are approaching the limit to the growth of towns.

Sir Daniel went on to say that there is no instance of a people flowing back to the country from the town, so that if the country flourishes, it must be by breeding its own men and finding a place for them. There are no longer vast vacant areas waiting for men. We must look elsewhere than to new lands for increasing the supply of food—to intensification rather than to enlarging the agricultural area.

Since the war, large estates all over Europe are being cut up into one-man farms. Sir Daniel believes these small units are fundamentally uneconomic, tending toward a community which becomes unprogressive and unable to take advantage of science and machinery. However, the only hope for the large estate, in his opinion, lies in what science can do to make its business successful and profitable. Whatever happens, the farmer himself is sure of a living. The economic value of agriculture, however, is to the community at large, and hence the community is concerned that agriculture should be as efficient as possible.

Research, Sir Daniel went on to say, may be regarded from two standpoints. In the first of these it is a purely intellectual affair carried out by the individual to satisfy the curiosity of the mind. As such it is an artistic impulse. Men are driven to do funda-

mental research as they are to write poetry or paint pictures. They are not drawn to it by any ulterior motive such as the usefulness of knowledge. Astronomy was cited as an example of this. Although it was originally necessary to determine the length of the year and the recurrence of seasons and later to provide information for sailors, it soon passed the point of being pursued because of its direct usefulness, but despite this the growth of observatories has gone steadily on.

The process of thought in research is the same as that in art. Facts are employed to test hypotheses. The Baconian idea was discussed, but it was pointed out that we can not profitably collect facts until we have a hypothesis to guide the process. Otherwise we will get no farther than the man who picks up stones, accumulating only a stone heap. The collection of meteorological and other data was cited as an instance where little was gained regarding theories until someone appeared with sufficient vision to construct a hypothesis. Neither induction nor deduction completes the story of the process by which research proceeds. Added to these is what the speaker designated as intuition, through which suggestion comes like a flash from the intellect of the genius.

Research may also, however, be conducted for its applications. The nineteenth century proved that research has a highly important use in attaining control over the forces of nature, and because of its value to the public it has received public support. This is particularly true of agricultural research, which must be supported by the State rather than by individual farmers; hence the promotion of agricultural research has become a function of the State in all civilized countries. Such being the case, there must be care to insure conditions which will lead to success in research. We must try to understand and adapt conditions to the psychology of the investigator, because, again, research is a type of art. We can not organize it into existence.

The provision of rewards in the form of large gifts, which have been suggested to stimulate research, he does not regard as fundamentally sound or desirable, but we can constitute a certain number of "sheltered places," as in the universities, in which the research worker can live and produce. That is Sir Daniel's remedy. We can not guarantee the output, but we can wait in faith. The hope for progress rests on the innate qualities of the investigator, his passion for an artistic expression.

These views contain some original conceptions which are most refreshing and stimulating. It is understood that the address is soon to be published in full, and it is hoped that it will receive the wide distribution and study which its importance deserves.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Principles of biochemistry, T. B. ROBERTSON (*Philadelphia: Lea & Febiger, 1924, 2. ed., rev., pp. XII+17-796, figs. 57*).—In this revision of the volume previously noted (*E. S. R.*, 44, p. 308), the principal changes include an expansion of the sections on the neutrality of the blood and metabolism in diabetes, a complete revision of the chapter on growth, a new chapter on the relationship of growth to diet, and new sections dealing with racemized proteins, the functions of the nucleic acids, and the inclusion of the environment as a factor in the evolution of higher animals.

Chemical synthesis, H. HEPWORTH (*London: Blackie & Son, Ltd., 1924, pp. XX+243, pl. 1*).—In this volume, which is one of a series of manuals of pure and applied chemistry edited by R. M. Caven, a survey is given of the more important of the modern investigations on the synthesis of natural organic substances, commencing with the photosynthesis of plant products and continuing with chlorophyll and other natural pigments, and the formation of carbohydrates, tannins, oils, fats, and waxes; terpenes and their derivatives; amino acids and organic bases; and alkaloids. References to the original literature upon which the discussion is based are given as footnotes, with more general references at the end of each section.

Chemical synonyms and trade names, W. GARDNER (*London: Crosby Lockwood & Son, 1924, pp. [3]+271*).—This useful dictionary contains approximately 14,000 definitions, with synonyms, chemical names, and formulas where possible, of minerals, dyestuffs, explosives, pigments, drugs, alloys, and commercial chemicals arranged alphabetically under trade names with numerous cross references.

The carbohydrates and the glucosides, E. F. ARMSTRONG (*London and New York: Longmans, Green & Co., 1924, 4. ed., pp. XI+293*).—The outstanding feature of the revision of this well-known monograph (*E. S. R.*, 43, p. 410) is the incorporation of the results of the investigations of Irvine on the chemical nature of the complex carbohydrates inulin, starch, and cellulose (*E. S. R.*, 51, p. 607).

The humin formed by the acid hydrolysis of proteins.—VIII, The condensation of indole derivatives with aldehydes, G. O. BURE and R. A. GORTNER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 5, pp. 1224-1246, figs. 2).—This continuation of the series of humin studies previously noted (*E. S. R.*, 49, p. 11), deals with an extensive investigation of the nature of the chemical reactions involved in humin formation and the structural configuration of the humin molecule.

About 40 humins were prepared, chiefly by condensation of various substituted indoles, with both aromatic and aliphatic aldehydes. Some of these humins were purified and analyzed with the following general conclusions:

"The humins from protein hydrolysis can not be prepared so that they are constant in composition. This substantiates the conclusions of previous workers. All formaldehyde humins have some oxygen in the molecule, while the

humins from α -methylindole and α -phenylindole with aromatic aldehydes contain no oxygen and the analyses correspond to the calculated value for one molecular equivalent of indole plus two of aldehyde minus two of water. Tryptophan forms, with both formaldehyde and benzaldehyde, humins which contain oxygen aside from that in the carboxyl group, and the humin with benzaldehyde gives an analysis corresponding to one tryptophan group plus two of benzaldehyde without the splitting out of any water. This same humin contains by analysis 2.21 per cent of amino nitrogen."

A diagram is given showing the synthesis and chemical properties of the humin prepared from α -methylindole and *o*-tolylaldehyde, the empirical formula for which is given as $(C_{25}H_{21}N)_x$, where x is not greater than 4.

A neglected chapter in chemistry: The fats, E. F. ARMSTRONG and J. ALLAN (*Jour. Soc. Chem. Indus.*, 43 (1924), No. 28, pp. 207T-218T).—This presidential address, delivered at the annual meeting of the Society of Chemical Industry of Great Britain at Liverpool, July 9, 1924, deals with the origin and significance of the fats. A brief summary is first given of the chemical structure of some of the members of each group of fatty acids. This is followed by a discussion of the distribution of the fatty acids in nature under the headings animal, vegetable, and marine animal fats, yeast fats, and waxes. In this section are included data on the composition of a number of fats as determined in the authors' laboratory. In the final section various hypotheses for the synthesis of fats are outlined and discussed.

The nature of the substances adsorbed on the surface of the fat globules in cow's milk, L. S. PALMER and E. SAMUELSON (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 537-539).—A preliminary report is given of an attempt to determine the chemical nature of the emulsion-stabilizing substances adhering to the fat globules in cow's milk.

Cream was repeatedly diluted with distilled water and recovered by centrifugal separation until the washings no longer gave a Fehling or a biuret test. The washed cream was then churned into butter, and the resulting buttermilk and the washings from the melted butter in warm water were subjected to a chemical study. The material was found to have a high ash content, consisting chiefly of calcium and phosphorus. By dialysis against distilled water and then against water at pH 4.6 all of the calcium was removed and the phosphorus reduced to 0.97 per cent of the dry substance. The remaining substance consisted apparently of a single globulin-like protein and a mixture of undetermined phosphatides, the latter comprising the greater part of the total raw material.

"The occurrence of both hydrophilic and hydrophobic colloids on the surface of the fat globules seems to offer an explanation both for the stability of the cream emulsion and for the relative ease with which the oil-in-water type of emulsion is inverted to a stable water-in-oil type of emulsion which occurs in churning cream to butter."

A technique for the study of fat production in animals, W. E. ANDERSON and L. B. MENDEL (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 436, 437).—It is noted briefly that many investigations on the relation of food fat to body fat are open to criticism on account of the number of variables entering into the experiment. In the method employed by the authors a standard basal ration has been adopted in which protein and inorganic salts are kept as constant as possible. In rendering the fat for analysis an autoclave kept under constant pressure for 14 or 15 hours is used. It has been found that variations in the diet result in marked differences in the composition of the body fat. With a preponderance of starch, a characteristic hard fat is

obtained, and with different oils typical oily fats, with iodine numbers and refractive indices depending upon the corresponding factors in the oils fed.

The phytosterols of the endosperm of corn, R. J. ANDERSON (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 6, pp. 1450-1460).—The author's studies on phytosterols (E. S. R., 50, p. 408) have been extended to corn endosperm, the material examined being the alcohol-ether soluble by-product obtained from corn gluten in the purification of zein. Commercial corn gluten and corn bran were also examined.

The first material contained some free phytosterol composed of two fractions varying slightly in melting point and optical rotation. After saponification the unsaponifiable fraction was separated into three parts consisting, respectively, of the optically active dihydrositosterol, $C_{27}H_{47}OH.H_2O$, melting point from 138° to 139° C; large quantities of sitosterol; and a brownish-yellow oily substance which has not yet been examined. Both the corn gluten and the corn bran contained sitosterol and dihydrositosterol. The latter crystallizes in the same form as sitosterol but in larger and denser crystals. It does not give the Liebermann-Burchard reaction and does not absorb bromine.

The effect of insulin upon the rate of fermentation of glucose by yeast, J. G. TRAVELL and J. A. BEHRE (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 478, 479).—It is reported briefly that in 12 experiments with 5 samples of insulin the fermentation of glucose by yeast was not affected to any appreciable degree by the presence of the insulin. This is thought to furnish evidence in favor of the view that the action of insulin is not upon the glucose molecule itself. "Were the glucose molecule altered through contact with the insulin, it would seem probable that an alteration in the rate of fermentation should be detectable even though the change produced by the insulin were only in the nature of a shift in equilibrium in the α -, β -, and γ -glucose molecules present."

The isolation of a crystalline substance (M. P. 223° C.) having the properties of "bios," W. H. EDDY, R. W. KERR, and R. R. WILLIAMS (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 6, pp. 307, 308).—The authors announce the isolation from autolyzed yeast of a crystalline compound which they believe to be chemically pure bios. The method employed depends upon fractional adsorption with fuller's earth to remove vitamin B and the subsequent use of colloidal ferric hydroxide to separate the bios from other impurities. The yield is about 0.03 per cent of the dry weight of the autolyzed yeast. The purified substance melts sharply at 223° C., is soluble in cold water, acid and alkaline solutions, and dilute ethyl alcohol, and is only slightly soluble in cold 95 per cent alcohol and in acetone. It is said to contain 43.29 per cent of carbon, 8.31 per cent of hydrogen, and about 25 per cent of nitrogen.

Vitamin B and bios, S. L. SMITH (*Jour. Home Econ.*, 16 (1924), No. 7, pp. 330-334).—This is a general discussion, with references to the literature, of the vitamins occurring in yeast and of the present significance of the terms vitamin B, vitamin D, and bios. A brief description is included of the method employed by Eddy et al. in the isolation of bios as noted above.

Adsorption by activated sugar charcoal.—[III], **Proof of hydrolytic adsorption,** E. J. MILLER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 5, pp. 1150-1158).—In this report of a continuation of the investigation previously noted (E. S. R., 49, p. 505), data are presented which are thought to prove that "adsorption of salts from aqueous solutions by pure activated sugar charcoal is accompanied by hydrolysis or decomposition, and that the acid arising from the hydrolysis is adsorbed by the charcoal while the base is set free and remains in solution. The proof is based on the following facts: (1) The method of preparation of the charcoal precludes the possibility of ascribing the effects

to impurities in the adsorbent; (2) the base set free in the aqueous solution is exactly equivalent to the acid recovered from the charcoal after adsorption; (3) the acid recovered from the charcoal is identical with the one from which the original salt is derived." This proved true with salts of both inorganic and organic acids.

On the determination and value of π_0 in electrometric measurements of hydrogen ion concentrations, S. P. L. SPØRENSEN and K. LINDERSTRØM-LANG (*Compt. Rend. Lab. Carlsberg*, 15 (1924), No. 6, pp. 40, figs. 3).—The principal questions discussed in this paper on standardization of methods in H-ion concentration determinations are the selection of electrodes for the determination, the best means of eliminating diffusion potential, and the selection of a standard value for π_0 . Data obtained in a study of these questions are reported and discussed, and proposals for standards of nomenclature and methods are presented. These follow in all essentials the recommendations of Clark in the second edition of his monograph on H-ion concentration (E. S. R., 51, p. 504).

Concerning the choice of electrodes, it is stated that "the saturated potassium chloride-calomel electrode should never be used as a standard electrode, but only as a working electrode, its potential being checked immediately before or after the measurement by measuring it against an electrode of known potential," and that "in specially accurate measurements, more than one calomel electrode should be used, and the constancy and durability of these should be tested from time to time against freshly prepared electrodes of the same sort, or against electrodes whose potential is known."

For elimination of the diffusion potential Bjerrum's extrapolation method is recommended. The standard value of π_0 at 18° C. "should be fixed at 0.3380 volts and defined as the electromotive force of a cell of which the left half consists of a 0.1 N potassium chloride-calomel-mercury electrode, the right half consisting of a hydrogen-platinum electrode in an electrode liquid having a concentration of hydrogen ions of 1 N, at 18° and with a hydrogen pressure of 1 atmosphere dry hydrogen, the diffusion potential being taken as eliminated."

Tests of a wet oxidation and modified Volhard method for the determination of chlorides in plant tissue fluids, J. V. LAWRENCE and J. A. HARRIS (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 6, pp. 1471-1477).—The general principles of the method described are summarized as "(a) the precipitation of all the chlorides by the addition of known excess of silver nitrate solution, (b) the destruction of all organic compounds (and hence the freeing of all chlorine which may be in organic combination as well as the decolorization of the fluids) by digestion with concentrated nitric acid at low boiling temperature, and (c) the determination of the excess of silver nitrate by titration with a standard solution of potassium thiocyanate, using ferric alum as an indicator." The technique of the process is described in detail, and data are presented on its accuracy as applied to plant and animal tissues. It is said to give excellent results for blood chlorides, but it is not recommended for this determination on account of the resistance of the hemoglobin to the action of nitric acid.

Some modifications of the picric acid method for sugars, J. J. WILLAMAN and F. R. DAVISON (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 5, pp. 479-488, figs. 2).—The Benedict-Lewis picric acid method for determining sugars has been subjected to a critical study at the Minnesota Experiment Station with respect to choice of color standards, effect of picric acid on glucose and fructose, effect of diluting the unknown color, clarification, the calculation of results, and the color factors for various sugars.

The color standard recommended is a 0.08 per cent glucose solution or a 0.076 per cent sucrose solution in saturated picric acid or in water. The picric acid solution should be used within a week and the water solution immediately. The maximum color development in glucose-picric acid solutions was found to take place after heating for 10 minutes prior to the addition of the sodium carbonate. It was found that on varying the degree of dilution of the solution the intensity of the color did not change proportionately with the dilution. It is consequently recommended that the solution be diluted always to the standard volume of 10 cc.

A comparison of various clarification methods showed that in many cases clarification is unnecessary. It is suggested that, when a number of samples of a given material are to be analyzed by the present method, lead clarification should be used on a few samples, and if no effect is noticed the clarification should be omitted.

To correct for the lack of proportionality between the intensity of the picramate color and the amount of sugar present, a table has been computed of factors to be used throughout the range of colorimeter readings. A table is also given of the color values of other reducing sugars in terms of glucose.

A method embodying the various modifications recommended is described in detail, and it is emphasized that, for comparative results in this determination or in any other colorimetric method "a given procedure and set of conditions must be decided upon, and then rigidly adhered to, whether they give maximum color intensities or not. The unknown color will be exactly comparable to the known, since they were both produced under exactly the same conditions. From this standpoint the most significant points in the present method are the effect of heat and picric acid on glucose, the use of the table of factors, and the use of exact amounts of reagents."

On the estimation of starch.—No. III, The estimation of starch in barley and wheat, A. R. LING, D. R. NANJ1, and W. J. HARPER (*Jour. Inst. Brewing*, 30 (1924), No. 9, pp. 838-845).—The discovery in certain starches of a hemicellulose constituent which is acted upon by malt diastase has led to a revision of the method of estimating starch in barley and wheat described in the first paper of the series (E. S. R., 50, p. 312). The modification depends upon the fact that pure potato starch contains no interfering hemicellulose and that in all starches the ratio of amylose to amylopectin is constant. Consequently, after determinations by the method previously described are made with the barley or wheat to be examined and with pure potato starch, the percentage of starch in the barley or wheat can be calculated by the formula $\frac{100m}{m'}$ where m represents the maltose found in the barley or wheat expressed on 100 parts of the dry grain and m' that found in the potato starch expressed on 100 parts of the dry starch. In determining maltose the iodometric method as modified by Baker and Hulton (E. S. R., 45, p. 504) is preferred to the cupric reduction method.

Factors influencing the determination of gluten in wheat flours, D. B. DILL (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 535, 536).—Attention is called to possible sources of error in the use of tap water for washing the gluten from wheat flour, and experiments are reported in which with a given flour tap water, distilled water, and sodium phosphate buffer solutions were used and determinations made of the wet and dry gluten and of the total nitrogen in the dried gluten. In addition, six flours were tested with buffer solutions of pH values from 4.4 to 7.6 in comparison with tap water, 0.1 per cent NaCl, and 0.1 CaCl₂.

There proved to be a greater loss of protein with distilled than with tap water. With the buffer solutions a concentration of 0.1 per cent and a pH value of 6.8 gave the best results. Sodium chloride and calcium chloride solutions gave unsatisfactory results. It is suggested that "uniform results in gluten washing may be obtained by the use of a sodium phosphate buffer solution which is approximately neutral in reaction and which has a concentration of 0.1 per cent."

The composition and decomposition of eggs, R. T. THOMSON and J. SORLEY (*Analyst*, 49 (1924), No. 580, pp. 327-332).—Miscellaneous data are reported on the composition of eggs, including particularly the percentage of fatty acids in fresh and stale egg yolk, analytical constants of the fat of hen's eggs, duck's eggs, and Chinese preserved egg yolk, and the reaction of egg yolk and white to indicators.

Food analysis: Typical methods and the interpretation of results, A. G. WOODMAN (*New York and London: McGraw-Hill Book Co., Inc., 1924, 2. ed., pp. X+529, figs. 108*).—A revision of the volume previously noted (E. S. R., 34, p. 610).

Practical chemical analysis of blood, V. C. MYERS (*St. Louis: C. V. Mosby Co., 1924, 2. ed., rev., pp. 232, figs. 33*).—In this revision of the volume previously noted (E. S. R., 48, p. 808) a chapter on the Folin-Wu system of blood analysis has been added. Some of the material on miscellaneous determinations, interpretation of results in blood analyses, and micro methods of urine analysis has been transferred to the main text from the appendix. The latter contains a discussion of types of colorimeters and their use, an alphabetical list of standard solutions and reagents, and the necessary tables for calculations.

Heat resistance studies.—I, A new method for the determination of heat resistance of bacterial spores, J. R. ESTY and C. C. WILLIAMS (*Jour. Infect. Diseases*, 34 (1924), No. 5, pp. 516-528, figs. 3).—It has been found necessary to modify the method for determining the thermal death points of heat resistant spores as developed by Bigelow and Esty (E. S. R., 45, p. 10) on account of certain irregularities which have been observed in the repeated use of this method.

In a series of single tubes heated for different times there has been noted a consistent and common occurrence of "skips." Up to a certain point duplicate cultures may both be viable, and beyond this point one may be viable and the other not. A series of experiments has been conducted in which large numbers of tubes all containing the same suspension were heated for different times within the range of the skips. The results of this study indicate that the skips are caused by variation in the resistance of individual spores in the suspension. For this reason it is recommended that at least 25 or 30 tubes be heated alike for at least four different times so selected as to cover the entire range of heat resistance based on the percentage survival. The larger the number of tubes heated for any time the more accurate is thought to be the percentage survival for that particular heating period.

"The heat resistance of bacterial spores is not a constant but depends on a large number of variables. Any statement regarding it should include all the conditions under which the spores are produced, heated, and subcultivated."

Cane juice clarification—theory and practice, J. F. BREWSTER (*La. Planter, Ref. Book Sugar Indus. World, July, 1924, pp. 55-57*).—Clarification of cane juice with lime is explained as a "colloid-chemical phenomenon (flocculation) brought about by purely chemical action and heat. The chemical reaction, in simple language, is that of an alkali with an acid, the most

important result of which is the adjustment of the H-ion concentration to the optimum for flocculation and settling. The writer's experience, covering several seasons with cane from various parts of Louisiana, would indicate that this optimum is at pH 7 for cold juice and normal cane."

The early sugar refining industry of New York, C. A. BROWNE (*La. Planter, Ref. Book Sugar Indus. World, July, 1924, pp. 31-39, figs. 12*).—This is an interesting historical sketch, illustrated by reproductions of engravings and drawings, of the beginnings of the sugar-refining industry of New York.

Cane sugar refining at the present day, H. Z. E. PERKINS (*La. Planter, Ref. Book Sugar Indus. World, July, 1924, pp. 39, 40*).—A brief description is given of the four basic operations in cane sugar refining, washing, clarification, decolorization, and crystallization.

Making fermented pickles, E. LEFEVRE (*U. S. Dept. Agr., Farmers' Bul. 1438 (1924), pp. II+17, figs. 2*).—This is a revision of and supersedes Farmers' Bulletin 1159 (E. S. R., 44, p. 557).

METEOROLOGY

The adjustment of agriculture to climate, J. B. KINCER (*Abs. in Bul. Amer. Met. Soc., 5 (1924), No. 8-9, pp. 123, 124*).—Discussing the general types of vegetation and of farming in relation to moisture and the limitations imposed by climate, especially water supply, upon food production as revealed in the history of migrations and increase in population during the last four or five centuries, the author expresses the opinion that, "if present tendencies continue, the question of food will be the dominant one to be met by the ingenuity of man in future ages."

Climate and quality of product [trans. title], E. FRIEDRICH (*Petermanns Mitt. Justus Perthes' Geogr. Anst., 70 (1924), Nos. 5-6, pp. 112-116; 7-8 pp. 159-163*).—This article reviews, with references, contributions bearing on the question of the influence of climatic conditions on a great variety of agricultural and other products and operations, including grape growing and the quality of wines, wheat, rye, barley, oats, corn, rice, sugar cane, sugar beets, indigo, tobacco, peanuts, chestnuts, oranges, olives, coffee, resin, milk, fish, oysters, pearls, furs, wool, silk, cotton fabrics, minerals, transportation and marketing, floods, and many others.

The weather as a factor in crop production, F. L. MUSBACH and M. L. KING (*Jour. Amer. Soc. Agron., 16 (1924), No. 6, pp. 381-383*).—Observations on the effect of temperature and precipitation on the yield and rate of growth of corn during the years 1918 to 1920, inclusive, at the Spooner Substation in the jack pine belt of Wisconsin, are recorded and briefly discussed.

Certain meteorological fallacies [trans. title], M. KOENIG (*Rev. Agr. Maurice, No. 9 (1923), pp. 145-149*).—This article deals largely with the question of the influence of the moon on the weather. The conclusion is substantially that such influence is not appreciable.

Sun spots and the frequency of tropical cyclones, S. S. VISHNER (*Amer. Jour. Sci., 5. ser., 8 (1924), No. 46, pp. 312-316, fig. 1*).—The analysis of the data presented "appears to suggest some relationship between spottedness and tropical cyclones," which, however, differs in different regions and is weak in all. There appears to be a very complex relationship, if any, "for storminess increases with spottedness when spots are few, then diminishes but later increases when spots are many."

The meaning of the equation, precipitation=run-off+evaporation+drainage [trans. title], K. FISCHER (*Met. Ztschr. [Brunswick], 41 (1924), No. 8, pp. 244-246*).—This is an attempt to express mathematically this relationship under varying meteorological conditions.

Climatological data for the United States by sections, [May–June, 1924] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 11 (1924), Nos. 5, pp. [190], pls. 3, figs. 2; 6, pp. [195], pls. 4, figs. 5.*)—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for May and June, 1924.

Climate of British Columbia, F. N. DENISON (*Brit. Columbia Dept. Agr. Bul. 27, 9. ed. (1924), pp. 20.*)—Tables are given which show the monthly and annual temperature, precipitation, sunshine, and relative humidity for the meteorological stations in British Columbia for the year 1923, with a more detailed summary of the weather during the year at Vancouver, Victoria, and Prince Rupert.

"The average temperature, precipitation, sunshine, and relative humidity is also given for those stations where 10 or more years' observations have been obtained. In 1923 the temperature was generally above the average and the precipitation below. Severe cold spells occurred in February and at the end of December. The summer was abnormally hot in the southern interior, accompanied by considerable rain and numerous thunderstorms."

SOILS—FERTILIZERS

Treatise on soils for farmers and foresters, E. A. MITSCHERLICH (*Bodenkunde für Land-und Forstwirte. Berlin: Paul Parey, 1923, 4. rev. ed., pp. XII+339, figs. 37.*)—This is the fourth revised edition of this book (*E. S. R., 31, p. 118*).

A rapid method of taking soil samples from field plots, E. P. DEATRICK and O. C. BRYAN (*Jour. Amer. Soc. Agron., 16 (1924), No. 8, pp. 486–488, fig. 1.*)—This method is briefly described and illustrated.

The Georgia soil survey, M. W. LOWRY (*Ga. Agr. Col. Bul. 299 (1924), pp. 16, figs. 9.*)—General information on the scope of the soil survey in Georgia is presented.

Soil survey of the Benson area, Arizona, E. J. CARPENTER and W. S. BRANSFORD (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+247–280, pls. 3, fig. 1, maps 2.*)—This survey, made in cooperation with the department of irrigation of the University of Arizona, deals with the soils of an area of 54,400 acres in southeastern Arizona which comprises a part of the San Pedro Valley in the west-central part of Cochise County. With the exception of areas in the vicinity of the valley trough, the drainage of the area is well established.

The soils are grouped as old valley filling, recent alluvial, and miscellaneous soils. Including riverwash and rough broken land, 14 soil types of 7 series are mapped, of which rough broken land, Anthony gravelly loamy sand, and McClellan silty clay loam cover 31.8, 16.4, and 11.2 per cent of the area, respectively. It is stated that the possibility of irrigation has influenced crop distribution more than has the character of the soil. Alkali is said to occur in the soils lying in the vicinity of the valley trough. The concentrations are high in some of the flatter areas but decrease with increase in elevation and slope. More or less black alkali occurs in all affected areas. The areas free of alkali are characterized by sufficient slope to insure good surface and internal drainage, and are much greater in extent than the affected areas.

Soil survey of Durham County, North Carolina, S. O. PERKINS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+1351–1379, fig. 1, map 1.*)—This survey, made in cooperation with the North Carolina Department of Agriculture and Experiment Station, deals with the soils of an

area of 186,240 acres lying wholly within the Piedmont Plateau province in north-central North Carolina. The topography is prevailingly undulating, gently rolling to rolling, and hilly. Practically all the county is well drained.

The soils range in texture and structure from light sandy soils to dark red clay loams. Twenty soil types of 14 series are mapped, of which the White Store fine sandy loam and sandy loam and Georgeville silt loam cover 25.5, 15.7, and 13.6 per cent of the area, respectively.

The soils of Brazos, Camp, Ellis, and Washington Counties, G. S. FRAPS (*Texas Sta. Bul. 316 (1924), pp. 5-88, figs. 6*).—Studies of the chemical composition and fertility of samples of typical soils from four counties of Texas surveyed by the U. S. D. A. Bureau of Soils (E. S. R., 25, p. 817; 29, p. 16; 32, p. 617; 35, p. 626) are reported.

The results showed that the soils of Brazos and Camp Counties require a legume rotation to supply nitrogen and vegetable matter and fertilizers to supply phosphoric acid. The Brazos County soils require lime in some cases, and the Camp County soils in some cases need potash. The soils of Ellis County are said to be generally well supplied with plant nutrients and lime, and the most important need is a proper rotation of crops including a legume to be turned under or grazed off. A marked difference is noted between the fertility of the upland soils and that of the bottomland soils of Washington County, and the Houston black clay soils seem to be better supplied with plant nutrients than the other upland soils. The greatest need of these soils is also a systematic rotation of crops including a legume. The upland soils also need some fertilizers, especially those containing phosphoric acid.

Soil series and types from the standpoint of hydrogen-ion concentration and lime requirement, J. S. JONES (*Soil Sci., 18 (1924), No. 1, pp. 65-74*).—In a contribution from the Oregon Experiment Station a brief description of the procedure followed in the classification of soil series and types on the basis of H-ion concentration and lime requirement is presented.

The resistance of soils to acidification [trans. title], A. DEMOLON and V. DUPONT (*Compt. Rend. Acad. Sci. [Paris], 179 (1924), No. 4, pp. 300-302*).—Experiments are reported which showed that soil solutions depleted of active calcium carbonate possess feeble buffer properties, which are due essentially to humates. Colloidal clay in reacting chemically toward dilute sulfuric acid was found to exercise a rapid and intense buffer action for the time being against this acid.

Alkali soil investigations.—II, Origin of alkali soils; physical effects of treatments, J. S. JOFFE and H. C. McLEAN (*Soil Sci., 18 (1924), No. 1, pp. 13-30, figs. 8*).—In a second contribution from the New Jersey Experiment Stations (E. S. R., 51, p. 617), a summary is given of the results of work from various sources on alkali soils, from which the conclusion is drawn that the theory of base exchange is the corner stone of the research on the origin of alkali soils. A series of curves is presented illustrating the capillary movement of water in alkali soils variously treated.

The aeration of soils as influenced by air-barometric pressure changes, G. J. BOUYOUKOS and M. M. MCCOOL (*Soil Sci., 18 (1924), No. 1, pp. 53-63, figs. 7*).—The results of studies conducted at the Michigan Experiment Station on the aeration of soils as influenced by barometric pressure are reported. The problem was studied by burying barographs in the soil and recording the march of the barometric pressure and comparing it with that in the air.

It was found that the barometric pressure of the soil down to a depth of 10 ft. was exactly the same as that in the air. Since this was true in all types of soil investigated, including the heaviest clays, it is considered reasonable to infer that the soil air has a free communication with the out-

side air down to the impervious stratum or water table. Calculations showed that when the amplitude of the barometric pressure is high and the depth of the impervious stratum large, the amount of aeration, or the depth to which new air will enter the soil, is correspondingly large. When these factors are small in magnitude, the degree of penetration of air is also small.

It seems, however, that barometric pressure has greater influence on soil aeration than is revealed by these calculations, but even according to calculations the amount of aeration is quite appreciable and important for the average fluctuation and depth of the impervious stratum. When the entire earth is taken into consideration the effect of barometric pressure on soil aeration is very large in some regions, especially in the tropical zones. From all evidence it appears, therefore, that barometric pressure is of greater importance in soil aeration than is commonly supposed.

Influence of heat on the total surface presented by soil elements [trans. title], L. SMOLIK (*Compt. Rend. Acad. Sci. [Paris]*, 178 (1924), No. 27, pp. 2266-2269).—Studies of the influence of temperature on the total surface of soil, as indicated by its hygroscopicity, are reported. In these studies the hygroscopicity was determined in fresh soil, in soil dried in air, and in soil dried at 50, 100, and 150° C. (122, 212, and 302° F.).

Temperature increases were found to diminish the total surface of soil as much as 50 per cent. This is taken to indicate that the increased fertility of soils after heating and drying is due to the decrease of the absorbing action of the soil surfaces, and consequently in the setting free of nutritive constituents. Further studies on the influence of freezing for 45 minutes on dried and moistened soils showed that there was no appreciable change in the dried soil as indicated by its hygroscopicity. In the moistened soil, however, there was a very considerable increase in the hygroscopic water, which is taken to indicate a marked increase in the total surface.

Iron, aluminum, and manganese in the soil solution of Hawaiian soils, W. T. McGEORGE (*Soil Sci.*, 18 (1924), No. 1, pp. 1-11).—Studies conducted at the Hawaiian Sugar Planters' Experiment Station are briefly reported.

The results showed that in Hawaiian soils normal potassium nitrate does not displace the aluminum in aluminum silicates except in those soils with pH values below 6. Soluble crystalloid salts of iron, aluminum, and manganese were found in soils with pH values below 5.8. At pH 6 or above manganese was not present in the soil solution, and iron and aluminum only as the hydrosols of ferric and aluminum hydrates. The solubility of manganese as indicated by the Comber test was found to be due to the greater H-ion concentration developed on shaking a soil with alcoholic potassium thiocyanate.

The cycle of sulfur in soil [trans. title], G. KLEIN and A. LIMBERGER (*Biochem. Ztschr.*, 143 (1923), No. 5-6, pp. 473-483).—Studies on the biology of the thiosulfate bacteria and their chemical activity in soil, with particular reference to their influence on the cycles of sulfur and nitrogen in soil, are reported.

It was found that these bacteria could live under aerobic conditions on inorganic as well as organic media. This is taken to indicate that they are capable of oxidizing all of the sources of inorganic sulfur in the soil to sulfate. It was also shown that these organisms are able to oxidize the sulfur contained in organic compounds such as cystine, albumin, nuclein, and meat extract. In all cases in the oxidation of sulfur in the presence of potassium nitrate, nitrite was formed, which eventually could be reduced to ammonia. When ammonium chloride was used as the source of nitrogen, nitrite was formed, which is attributed to an additional biochemical activity of the thiosulfate bacteria.

Elementary sulfur in the forms of drops or grains was separated from all of the inorganic, organic, liquid, and solid media by the action of these bacteria, and from agar almost always in the form of crystals. These organisms were found not only in water and soils but also frequently in the adjacent air. It is concluded that the thiosulfate bacteria play an important part in the transformation of nitrogen and sulfur in the soil.

Nitrification and the nitrifying organisms, I. R. N. GOWDA (*Jour. Bact.*, 9 (1924), No. 3, pp. 251-272, fig. 1).—Studies conducted at Iowa State College on methods for the isolation of nitrifying organisms are reported.

The results showed that the bouillon test for purity of nitrite- and nitrate-forming organisms is not conclusive, due possibly to the fact that the organisms developed tolerance for bouillon. The nitrite-forming organisms may rapidly lose their power of oxidation of ammonia when grown in pure cultures. Free carbon dioxide was found to be essential for the oxidation of ammonia by these organisms and promoted ammonia oxidation better than normal air.

The nitrite-forming organisms grew most rapidly in soil extract washed agar. The carbonaceous material in soil extract did not act as a source of carbon to these organisms when free carbon dioxide was not available. The nitrifying organisms were found to oxidize ammonia to nitrite and the nitrite to nitrate in the presence of growing plants.

Further progress in the improvement of arable land, J. STOKLASA (*Internatl. Rev. Sci. and Pract. Agr. [Rome]*, n. ser., 1 (1923), No. 4, pp. 838-847).—In a contribution from the State Experiment Station of Czechoslovakia a summary is given of the progress of studies in soil biology, with particular reference to the improvement in the fertility of arable soils. The conclusion is drawn that, biologically speaking, the colloidal content of soil is the most decisive factor. The principal groups of organisms are the Actinomycetes and different species of fungi and algae.

The largest quantities of bacteria were found to occur in fields where sugar beets and clover or lucern had been grown and in good garden mold. Most of them were the rodlike forms. All of these microorganisms were found to require, in addition to oxygen and water, certain quantities of nitrogen, carbon, phosphorus, potassium, and other elements in easily assimilable form. They contained from 40 to 50 per cent of carbon, which is taken to indicate that they need larger amounts of carbon than of the other substances.

The intensity of the respiration process in the auto- and heterotrophic microorganisms of soils was found to vary enormously and to depend on the physical, chemical, and mechanical properties of the soil. Numerical data are given which indicate how the respiration intensity of the microorganisms in a soil is a criterion of its fertility.

Sub-soiling trials in Essex (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1924), No. 11, pp. 1000-1007).—Experiments on the effect of subsoiling on sand, gravel, brick earth, boulder clay, and London clay soils on the yield of potatoes, wheat, and barley are reported.

These experiments showed that in the first year every subsoiled plat produced an increased yield, the value of which was greater than the extra cost of subsoiling over plowing. The results indicated that the best depth of subsoiling may vary from field to field even in the case of soils apparently similar in character. This is taken to indicate the advisability of experimenting at different depths for the first year.

Manuring for profitable production, F. E. CORRIE (*Lingfield, Eng.: Author*, 1924, pp. 24, fig. 1).—This is a popular handbook for farmers and students on the proper selection and use of fertilizers and manures, with special reference to English conditions.

Economic returns from fifteen years' results with manure, fertilizers, and lime on Sassafras silt loam soil, G. L. SCHUSTER (*Delaware Sta. Bul.* 138 (1924), pp. 3-47, figs. 21)—A further study of the 15 years' observations and results with manure, fertilizers, and lime on Sassafras silt loam soil as set forth in Bulletin 137 of the station (E. S. R., 51, p. 621) is reported.

This study showed that for general farm crops in a rotation including a legume to be harvested or plowed under, potash is the first factor that limits crop production, phosphoric acid second, and nitrogen third.

Manure was about equal to a complete fertilizer in producing profits. A combination of basic slag and potassium chloride ranked next to acid phosphate and potash in producing a profit, and rock phosphate and potash ranked last. The value of lime is considered to be questionable. It produced a profit when used in connection with potassium chloride, but where used alone or with other fertilizer combinations the profit was so small as to be negligible, and in some instances a loss resulted.

Potassium chloride was the only single fertilizer material which improved the quality of grain, and acid phosphate and potassium chloride comprised the outstanding combination of two materials in improving the quality of grain, giving better results than the potassium chloride alone. When sodium nitrate was added to acid phosphate and potassium chloride it caused a still greater improvement in the quality of wheat and corn, but its value on soy beans was questionable. The proper use of fertilizers was found to produce a more uniform yield and quality as well as a better quality and higher yield of grain.

Some changes brought about in cylinder soils by long continued crop and fertilizer treatment, A. W. BLAIR and A. L. PRINCE (*Soil Sci.*, 18 (1924), No. 1, pp. 31-52, fig. 1).—Studies conducted at the New Jersey Experiment Stations are reported which showed that cylinder soils which had been heavily fertilized and cropped under controlled conditions for a period of 25 years indicated, on analysis, a gain in total phosphoric acid content. This is taken to indicate that during this period more phosphoric acid was applied to the soil than was removed by the crops. Soil which received phosphoric acid at the rate of 100 lbs. per acre showed but little actual loss of this constituent. Where phosphoric acid was used at the rate of 200 lbs. per acre the apparent loss was more than three times as much as that when 100 lbs. was used. Larger crops were obtained with the double than with the single portion of phosphoric acid, but the yield was not increased in direct proportion to the increase in fertilizer applied. The results indicated further that with average fertilizer treatment very little phosphoric acid is actually lost in the drainage waters; the heavier the application, however, the greater is the loss.

Determinations of potash in the soil from a number of the cylinders showed a loss of this constituent, although potash had been used each year in amounts considerably above the general average required for the crops used. The total amount of potash applied during 25 years was so small in comparison with the total amount originally present that this apparently had little to do with changing the potash content of the soil. Evidently the greatest change came about through the removal of potash in the crops and in drainage waters.

The soil from all cylinders which had not been limed showed a lower percentage of calcium oxide than the original soil. With five exceptions all the cylinders which had been limed showed a higher percentage of lime than the original soil. The greatest loss of lime was noted where ammonium sulfate had been used continuously without lime or manure. The soil on all the unlimed cylinders was found to be acid. With slight exceptions the soils of the limed cylinders had no lime requirement, and showed pH values varying from 6.5 to 7.3.

Different fertilizer experiments on moor soils [trans. title], C. J. CHRISTENSEN (*Tidsskr. Planteavl*, 29 (1923), No. 3, pp. 462-509; *abs. in Biedermann's Zentbl.*, 53 (1924), No. 6, pp. 167-170).—Fertilizer experiments on both upland and lowland moors are reported.

Experiments to determine the influence of kainit and Thomas meal on meadow and on oats, barley, and potatoes showed that in all cases the best yields were obtained when the Thomas meal and kainit were used together.

Comparative experiments with different phosphatic and potassic fertilizers, lasting for two years in the case of meadow and for three years in the case of the other crops, indicated no great difference between the various fertilizers as judged by crop yields. This was especially true in the case of Algerian, Tunisian, and Gafsa phosphates when used in the winter and spring on meadow. Phonolite was not so good a source of potash on meadow as 37 per cent potash salt even when used in double amounts.

Sodium nitrate increased the yields of all crops on both upland and lowland moor soils, the better results being obtained on the upland. Its use on potatoes was especially profitable. However, the use of excessive amounts on grain crops appeared to be detrimental to grain formation. The best results were obtained on lowland moor soils with nitrogenous fertilizers on hay and the poorest on root crops.

[Soil and fertilizer studies in India, 1922-23] (*India [Dept. Agr.] Rev. Agr. Oper.*, 1922-23, pp. 50-57).—This report continues work previously noted (*E. R. S.*, 50, p. 209).

Studies at Pusa on the available phosphoric acid in calcareous soils showed that a 1 per cent solution of potassium carbonate is the most convenient solvent for this purpose in that, while extracting an appreciable amount of phosphoric acid, it is not naturally affected by the presence of varying amounts of calcium carbonate. The decrease in permeability of soils in lysimeters with free drainage was apparently associated with the formation of colloids in the soil, and was always noticeable when the supply of organic matter needed renewal. Observations on the movements of nitrates in the soil and subsoil showed that for the conservation of nitrates the best types of soil are those which possess a fairly heavy layer at a depth of from 3 to 4 ft., and that from the standpoint of nitrogen conservation the value of green manuring during the earlier stages of the monsoon is questionable owing to the rapidity with which the nitrate is leached.

Studies on the storage of barnyard manure at Madras showed that manure which is compacted in a box by the cattle themselves is richest in nitrogen. For the production of artificial barnyard manure paddy straw yielded good results, but in the case of waste material such as prickly pear, lantana, etc., large losses of nitrogen occurred.

Permanent manurial rotation studies at Pusa are said to have demonstrated the residual effect of large applications of fermented green manure and the effectiveness of such applications in conjunction with the use of superphosphate. In studies on the solubility of rock phosphate, great increases in the percentage of phosphoric acid rendered soluble were obtained by the use of cultures of sulfur-oxidizing bacteria when the phosphate was composted with sulfur. The addition of gypsum to the sulfur-phosphate compost improved the physical texture of the mass and increased the solubility of the phosphoric acid.

Experiments with calcium cyanamid at Madras, gypsum at Pusa, urea at Nagpur, and lime at Jorhat in Assam are also briefly described.

[Soils and fertilizer experiments at the Wellcome Tropical Research Laboratories, Khartum], A. F. JOSEPH (*Wellcome Trop. Research Labs., Chem.*

Sect. Pub. 30 (1923), pp. 8-30).—Experiments to compare the results of mechanical analyses of six soils of different origin by the Robinson method and the so-called Sudan method gave an average variation of 3.7 per cent in the clay content. Preliminary acid treatment resulted in an apparently lower proportion of clay, the average decrease being 1.7 per cent. On the other hand, a low result was obtained by the omission of acid treatment in the case of soils containing calcium carbonate and a higher proportion of organic matter than usual.

Studies on the relation between the salt content of soils and crop yield showed that for good and bad yielding plats taken from the same area during the same season there was a correlation between high salt content and low yield. Analyses of soil alkali showed that the water-soluble portion of the soil consists almost entirely of sodium salts. These occur mainly as carbonate in the first 2 ft., with increasing proportions of sulfate and chloride in the third and fourth foot.

In experiments on the effect of storage on soils at ordinary temperatures, it was found that such treatment so improved a soil as to change it from a water-logging to a nonwater-logging soil. Even where this did not take place the moisture equivalent was so reduced as to indicate an improvement in texture. Heating was found to hasten somewhat the improvement of water-logged soils by storage.

Data on the chemical and physical properties of clay fractions; H-ion concentration of soils; the action of electrolytes on soil, clay fractions, and silica; the flocculation and sedimentation of clay; the separation of clay into sub-fractions; and the properties of humus are reported. Field experiments on nitrification, the use of gypsum, and the fertilization of wheat are also briefly described.

Fertilizer experiments with fine waste and mixed fertilizers as a beginning for the industrial use of municipal sewage, garbage, and sewage sludge [trans. title], J. BODLER (*Gsndhts. Ingen.*, 47 (1924), No. 26, pp. 266-279, figs. 6).—Experiments on gravelly soil deficient in humus with such crops as beets and barley to determine the fertilizing values of sifted garbage and sewage sludge as compared with that of a mixture of ammonium sulfate nitrate, superphosphate, and potassium chloride are reported.

The results showed that the fertilizing value of sifted garbage and sludge is so much greater than its heating value as to make burning an uneconomical procedure. Mixed fertilizer containing this material was found to be especially valuable for light sandy and gravelly soils and for heavy loam and clay soils deficient in humus. More generally favorable results were obtained with such a mixture than with commercial fertilizers.

The value of some green manures, L. KOCH (*Trop. Agr. [Ceylon]*, 62 (1924), No. 6, pp. 351-356).—Studies conducted at the General Agricultural Experiment Station at Buitenzorg on the relative values of different types of green manure are briefly summarized.

The greater part of the dry matter was found to occur in the stems. This is taken to indicate that the woody parts of green manure plants are of high importance for humus formation.

Studies of the nitrogen content showed that this element is confined largely to the leaves and young twigs and that the woody stems and roots contain only from one-seventh to one-third of the total. It was found that if the time for growing a leguminous crop is short only certain plants may be grown profitably, while for planting between perennial crops, such as rubber and coffee, usually the slower growing leguminous plants which can be pruned repeatedly

should be used. The phosphate content varied widely among the different types of green manuring plants.

Possibilities and limitations of bacterized peat, T. F. MANNS (*Jour. Amer. Peat Soc.*, 17 (1924), No. 3, pp. 81-104).—Studies conducted at the University of Delaware are reported which showed that muck humus of the quality used in the experiments becomes a very favorable medium for beneficial soil flora when properly balanced and reinforced. The flora of virgin muck humus was found to be deficient in many of the beneficial bacteria. Different legume nodule organisms were absent, although a limited number of the clover group were present. Muck humus when properly reinforced, inoculated, and composted was able to carry the several groups of the different legume organisms in one and the same compost, producing a strong inoculation of the legumes.

Inoculation of the compost could be satisfactorily brought about by using soil which had been proved to give strong inoculation to each of the groups of legumes. *Azotobacter chroococcum* could be readily introduced by using western soils.

Treated muck humus gave a strong inoculation to five groups of legumes when grown in sterilized sand cultures, using the compost at the rate of 2 lbs. per acre of 2,000,000 lbs. A somewhat stronger inoculation and growth were produced by using the compost at the rates of 100 and 500 lbs. per acre in sand cultures. Crude carbohydrates and basic compounds such as organic ash and Thomas slag were very efficient in promoting an active legume flora, and likewise a strong nitrogen-fixing and nitrifying flora. Organic ash proved to be the most active mineral application for use in the compost, as indicated by crop response.

By properly reinforcing the composts with certain basic compounds, all the nitrogen required for crop response was made available, as indicated by the growth of millet. The crop response from additional nitrogen from cyanamide guano did not equal that from certain of the composts.

These results are taken to indicate that nodule organisms will live in a muck humus having a lime requirement of 5,000 lbs. of calcium oxide per acre of 2,000,000 lbs., and that in this same acidity alfalfa, red clover, soy beans, and cowpeas will grow and become inoculated without the addition of any bases.

The action of dicyandiamid and guanyl urea sulfate on plant growth, A. F. McGUINN (*Soil Sci.*, 17 (1924), No. 6, pp. 487-500).—Studies conducted at the New Jersey Experiment Stations are reported which showed that dicyandiamide and guanylurea sulfate do not retard or inhibit germination when applied in small quantities in direct contact with seed. Dicyandiamide is slightly toxic to plant growth when applied in large amounts as the sole source of nitrogen, but in small amounts it produces no injury, except a slight tipburning, when other available nitrogen is present. Guanylurea sulfate is not toxic to plant growth in comparatively large applications and becomes very slowly available as a source of nitrogen.

Minimal quantities of dicyandiamide stop the nitrification process but do not retard ammonification. Guanylurea sulfate retards nitrification slightly but does not affect ammonification. Neither substance affects the number of bacteria and fungi in the soil. Dicyandiamide is very stable in the soil. Guanylurea sulfate is also comparatively stable but decomposes to ammonia very slowly. The fertilizing value of urea is approximately equal to that of sodium nitrate, and its value is not lessened if 10 per cent of its nitrogen is in the form of dicyandiamide or guanylurea sulfate.

The new nitrogenous fertilisers of Great Britain, E. J. RUSSELL (*Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 4, pp. 848-856).—In a contribution from the Rothamsted Experimental Station a review is given

of results obtained in Great Britain with calcium nitrate, ammonium nitrate, urea, ammonium chloride, and cyanamide.

Nitrogen experiments with legumes [trans. title], SCHNEIDEWIND (*Mitt. Deut. Landw. Gesell.*, 39 (1924), No. 18, pp. 335, 336).—Nitrogen fertilization experiments with alfalfa, peas, and lupines are briefly reported, showing that in some cases there was no profitable increase in yield and in others even a decrease in yield resulting from nitrogen fertilization. These results are taken to indicate that a favorable action of nitrogen fertilization on legumes is not always certain or profitable.

Fertilizer value of different phosphates [trans. title], H. NIKLAS, A. STROBEL, and K. SCHARRER (*Ztschr. Angew. Chem.*, 37 (1924), No. 33, pp. 617-620).—Experiments on four different soils with potatoes, rye, sugar beets, and oats to determine the relative values of superphosphate, Rhenania phosphate, dicalcium phosphate, and Thomas meal as sources of phosphoric acid are briefly reported. The results showed that the phosphoric acid requirement of the soil in general bears little relation to the phosphoric acid content determined analytically. Superphosphate and Rhenania phosphate gave practically the same results, followed in order by dicalcium phosphate and Thomas meal.

The American fertilizer hand book, 1924 (Philadelphia: Ware Bros. Co., 1924, 17. ed., pp. [454], figs. 14).—This number of this handbook contains the usual list of fertilizer manufacturers and buyers' guide, data on trade in fertilizers and fertilizer materials, and special articles on fertilizers.

Commercial fertilizers (*Md. Univ. Quart.*, No. 108 (1924), pp. 36).—Guaranties, actual analyses, and comparative valuations of 712 samples of fertilizers and fertilizer materials collected for inspection in Maryland from January 1 to July 1, 1924, are presented.

AGRICULTURAL BOTANY

The influence of nutrients on the development of plants [trans. title], G. LAKON (*Angew. Bot.*, 5 (1923), No. 2, pp. 110-117).—This is largely a critical discussion of recorded research and opinion.

The effects of a high nutrient supply on the apparatus of assimilation [trans. title], K. MAIWALD (*Angew. Bot.*, 5 (1923), Nos. 1, pp. 33-48; 2, pp. 49-74).—Tabular details and a discussion are given regarding various nutrients in relation to the development of potato plants and tubers.

Relation of the molecular proportions in the nutrient solution to the growth of wheat, M. C. SEWELL (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 4, pp. 387-393, figs. 4).—A report is given of an investigation made to determine the comparative effects of varying proportions of potassium dihydrogen phosphate, calcium nitrate, and magnesium sulfate on the growth of wheat at different stages. The results are said to indicate an interesting relation between the nitrogen and phosphorus potassium salts in the growth response. With a high molecular proportion of nitrogen, a maximum grain yield was obtained with a low molecular proportion of the phosphorus potassium salt. With a low molecular proportion of nitrogen, equally high grain yields were obtained only with a high proportion of the phosphorus potassium salt.

These experiments are said to show the importance of nitrogen in the development of the wheat plant, and to indicate that when there is a sufficient supply of nitrogen in the soil the plant will produce a maximum yield with less of the elements containing phosphorus and potassium.

The availability of iron in nutrient solutions for wheat, W. E. TOTTINGHAM and E. J. RANKIN (*Amer. Jour. Bot.*, 10 (1923), No. 4, pp. 203-210, figs.

4).—"Results are here given relative to the solubility and availability to young wheat plants of various compounds of iron in a particular form of nutrient solution. Solubility tests at different pH values of the nutrient solution have shown that ferric phosphate is relatively insoluble. This is true of ferric and ferrous sulphate at a H-ion concentration of the iron-free nutrient solution approaching neutrality. While ferric citrate is not very soluble, it possesses the advantage of remaining soluble over a considerable range of pH values of the nutrient solution.

"Ferric sulphate increases the H-ion concentration of the nutrient solution here used, while ferric citrate causes the opposite effect. The other forms of iron tested have little influence in this respect. The growth measurements of the young wheat plants show that ferric citrate was decidedly the most favorable form of iron employed. The variation in efficiency of iron in the forms supplied is correlated with variation either in the solubility of this element or in the modification of the pH value of the nutrient solution. The results show clearly that ferric phosphate is likely to be inefficient because of its low solubility. Ferric citrate supplied at the rate of 10 mg. of iron per liter of the nutrient solution employed here is not completely dissolved, but seems to provide abundant iron for the growth of the young wheat plant where the nutrient solution is renewed."

The effect of the hydrogen ion on the protoplasm of the root hairs of wheat, R. M. ADDOMS (*Amer. Jour. Bot.*, 10 (1923), No. 4, pp. 211-220, pl. 1).—Seedlings of spring wheat grown in solutions selected from Shive's optimal group (*E. S. R.*, 36, p. 328) were studied in regard to the general or local extent of any harmful effect of the H-ion and the effect of concentrations.

"The abnormal root development and decreased growth that have been observed in plants grown in nutrient solutions that contain relatively large amounts of potassium dihydrogen phosphate may be explained by the coagulation of the protoplasm of the root hairs. This coagulation, which is accompanied with flocculation, is found to be induced by the H-ions formed by dissociation of the phosphate. The H-ion concentration of the nutrient solutions employed varied from pH 3.94 to pH 3.47. The relation of this coagulation and flocculation to the colloid chemistry of the protoplasm is discussed. The lack of logic in the attempts . . . to find a direct relation between environmental features, such as H-ion concentration, and the dry weight of plants, is pointed out."

An isoelectric point for plant tissue and its significance, W. J. ROBBINS (*Amer. Jour. Bot.*, 10 (1923), No. 8, pp. 412-439, figs. 6).—The work here described includes experiments dealing with the absorption of water by potato tuber tissue in solutions of different H-ion concentrations and experiments on the absorption of dyes by plant tissue which had been in contact with solutions of different H-ion concentration.

"The results which are reported in this paper on the absorption of water and on the absorption and retention of acid dyes by potato tuber tissue can be explained by the assumption that an ampholyte, possibly a protein, plays the chief part in these processes and that its isoelectric point is in the vicinity of pH 6. The absorption of basic dyes by potato tuber tissue is complicated by the fact that the starch, the cell walls, and possibly other constituents of the cell, such as the pentosans, combine with the basic dyes at all the reactions involved.

"It is of course difficult to conceive of protoplasm as consisting of but one ampholyte with a single isoelectric point. The point to which we have called attention here may represent the resultant of the isoelectric points of several cell constituents."

Studies on the relation of aeration and continuous renewal of nutrient solution to the growth of soybeans in artificial culture, R. V. ALLISON and J. W. SHIVE (*Amer. Jour. Bot.*, 10 (1923), No. 10, pp. 554-566, pl. 1, figs. 2).—“Solution or sand cultures with continuous solution renewal by which 1 liter of new solution per culture was supplied during each 24-hour interval throughout the growth period always produced plants which were superior in every respect to those grown in cultures with intermittent solution renewal. However, the best plants with respect to health, vigor, and yields always occurred in the cultures with continuous solution renewal and with constant and thorough aeration of the medium.

“Aeration of solution or sand cultures which maintained the maximum supply of dissolved oxygen (approximate saturation) in the culture solutions, renewed intermittently, had no apparent influence upon the growth of soy bean tops, but it produced considerable increase in root development. Aeration of solution or sand cultures with continuous solution renewal produced a marked increase in the growth of both tops and roots of soy beans.

“Continuous renewal of the nutrient solution did not alone maintain the supply of dissolved oxygen necessary for maximum development of the plants. The response of roots to aeration was much more pronounced in the cultures in which the solutions were continuously renewed than it was in those in which the solutions were only intermittently renewed. The superiority of roots grown in the aerated media over those grown in the nonaerated was manifested not so much in higher yield weights as in the development of very efficient absorbing systems consisting of long, slender main roots thickly beset with well-developed laterals, giving rise to very extensive absorbing surfaces. The superior root growth resulting from aeration of the cultures with continuously renewed solutions was particularly reflected in accelerated top growth during the later stages of development. The average total yields obtained from the sand cultures were throughout uniformly much higher than were those obtained from the solution cultures.”

The effect of ringing a stem on the upward transfer of nitrogen and ash constituents, O. F. CURTIS (*Amer. Jour. Bot.*, 10 (1923), No. 7, pp. 361-382, fig. 1).—From a variety of experiments (*E. S. R.*, 44, p. 323) to determine the effect of ringing on the upward transfer of carbohydrates, evidence was obtained indicating that these foods are carried by the stem chiefly through the phloem tissues even though much of the food to be transported is present as sugar or starch in the xylem tissues. At least the upward transfer of sugars seems to be very clearly checked by the removal of a ring of phloem.

“Experiments are reported showing the effects of ringing a stem on the upward transfer of nitrogen and ash constituents. Data from such experiments with privet, peach, and lilac are presented. The data show that a ring distinctly hinders the movement of nitrogen and of ash constituents into the leaves above the ring, either when the ring is made in the spring before the leaves open and the new xylem is laid down, or when it is made in the summer after they have opened and the new xylem is partly or fully formed. When sodium nitrate, with or without other nutrient salts, is added to the soil, the nitrogen and ash contents of the leaves from unringed stems increase to a much greater extent than do those of the leaves from ringed stems. This is true whether data are expressed per unit of dry weight, per unit of leaf surface, or as absolute quantities.

“The stems also were analyzed to determine whether or not the low nitrogen content of the leaves could be accounted for by accumulation of nitrogen in the stems. These analyses, whether of the entire stem or of the wood and bark separately, showed a lesser content in the ringed stems. A single experiment

was tried in which an attempt was made to eliminate the influence of altered transpiration or of change in carbohydrate content. In this experiment, evidence was obtained indicating that the low nitrogen content above a ring is not due to a lessened transpiration or to a changed carbohydrate content. The data can not be considered as conclusively proving that nitrogen or other nutrients move upward primarily through the phloem and not through the xylem, for the treatments may have altered the xylem tissues. Aside from such a contingency, however, these data from ringing experiments offer strong evidence indicating that nutrients are carried chiefly in the phloem."

Amylase in the spores of *Rhizopus tritici* and *Rhizopus nigricans*, L. L. HARTER and J. L. WEIMER (*Amer. Jour. Bot.*, 10 (1923), No. 2, pp. 89-92).—"An enzyme capable of hydrolyzing Irish-potato starch paste to reducing sugars is produced in the spores of *R. tritici* and *R. nigricans*. Within the limits of these experiments the enzyme is produced at any temperature at which spores are produced."

The influence of plants on the air in houses, G. B. RIGG, T. G. THOMPSON, and W. L. GILLILAND (*Amer. Jour. Bot.*, 10 (1923), No. 7, pp. 383-386).—"Determinations of the carbon-dioxide content of the air in a greenhouse indicate that the concentration of this gas did not at the time of any determination reach a high enough concentration to be injurious to human beings. Under the conditions existing in this greenhouse the effect of plants in increasing carbon-dioxide content is negligible in comparison with the effects of the people who visit the greenhouse."

The formation and degeneration of germ cells in the potato, W. J. YOUNG (*Amer. Jour. Bot.*, 10 (1923), No. 6, pp. 325-335, pls. 3, figs. 2).—"The present study was carried out in connection with the potato-breeding project at the South Carolina Experiment Station and is presented as a contribution from the department of horticulture of that institution, being intended as a supplement to the material presented in Bulletin 210 (E. S. R., 47, p. 433). The primary object of the work is to follow the degenerative changes in the germ cells on account of the bearing that such changes might have upon the failure of most potato varieties to set seed."

The potato is a difficult subject, on account of the small size of the cells and the degenerative changes preceding the shedding of the blossoms. "The development of the flower and of the germ cells does not show any marked differences from cases previously described for related plants. Degenerative changes in the anther contents show decided differences according to the stage at which degeneration begins. Changes which occur at early stages of development appear to be due to unfavorable climatic or environmental conditions. The disintegration of nearly mature pollen grains appears to be the result of hereditary pollen sterility and does not interfere with the normal anthesis of the blossoms. Degenerative changes in the ovules and embryo sac appear to result from unfavorable environment and may occur at any stage. They are much more uniform in character than those found in the anther. Varieties which produce no viable pollen may set fruit and produce seed, provided environmental conditions are not such as to induce degenerative changes in the embryo sacs, and provided the blossoms are promptly crossed by a variety producing viable pollen."

The photoperiodism of *Tephrosia candida*, T. B. McCLELLAND (*Jour. Agr. Research [U. S.]* 28 (1924), No. 5, pp. 445-460, pls. 4, figs. 7).—"Following the publication by Garner and Allard on the effect of the length of daily illumination on the behavior of plants (E. S. R., 42, p. 818), the author carried on a series of experiments with *T. candida*, a leguminous plant used as a cover crop in Porto Rico."

The extreme length of day at the Porto Rico Experiment Station varies from 11 to 13.2 hours, and the plants studied showed striking response to the different lengths of day. Blossoming was inhibited both by a day length shortened to 10 hours and by a day length of 13.2 hours. Shortening the day from the long day of summer to a 12-hour length promptly induced blossoming, whereas a continuation of exposure to the long summer days inhibited it. Under a day length artificially protracted to 13.5 hours for 10 weeks buds failed to appear, but on shortening the day length they promptly appeared. Although autumn is the normal blossoming season for *T. candida* in Porto Rico, heavy blossoming was induced in April through artificial manipulation of the length of light exposure or day length. Day length was found not only to determine the blossoming season but also to affect the growth of the plants in a decided manner, the longer days producing growth with longer internodes and larger leaves.

Observations on the causes of gregarious flowering in plants, W. SEIFRIZ (*Amer. Jour. Bot.*, 10 (1923), No. 2, pp. 93-112, pl. 1).—An inquiry into the factors concerned in gregarious flowering and in general periodicity, with results that are somewhat inconclusive.

Alternation of sexes and intermittent production of fruit in the spider flower (*Cleome spinosa*), A. B. STOUT (*Amer. Jour. Bot.*, 10 (1923), No. 2, pp. 57-66, pl. 1, fig. 1).—In the cultures of *C. spinosa* grown for this observational study, wide variation appeared in the morphological character of the flowers as regards relative development of the two kinds of sex organs. On a single plant were bisexual flowers, flowers functional only as males or as females, and many intergrading types. The variation from one extreme to the other was repeatedly cyclic, which condition results in the intermittent production of fruit. The alternative loss of maleness and femaleness in the flowers of *C. spinosa* and the recurring periodic changes in the sex of flowers are, it is thought, to be regarded as phenomena of internal and biogenetic regulation closely related to those influences which determine the development of the plant as a whole.

"In *C. spinosa* it is evident that there are rather special and perhaps very specific stimulating and inhibiting influences which regulate the development of the sex organs. Whether these influences are substantive or more of the nature of stimuli, their action is cyclic and decidedly alternative. The results clearly show that sex of flowers is determined progressively as they are formed in response to regulation by internal biogenetic conditions."

The physiology of incompatibilities, A. B. STOUT (*Amer. Jour. Bot.*, 10 (1923), No. 9, pp. 459-461).—A brief general survey is given of physiological incompatibilities in fertilizations within species and between species, the two classes of incompatibilities supposedly having very different physical bases.

Results from a study of the species *Brassica pekinensis*, together with other behavior noted, indicate a direct and decided physiological correlation between vegetative vigor and the functional properties of the organ concerned with fertilization. This is suggestive that the physiological conditions which restrict and limit indiscriminate fertilization within species are not only subject to internal regulation, but that in some cases at least they are correlated with changes in vegetative vigor. "The situation gives hope that the cyclic expression of sexual affinities and the development of extremes of compatibility may be so regulated experimentally that the specific biogenetic factors and conditions operating in this highly specialized differentiation may be determined."

[The species concept], G. H. SHULL, R. A. HARPER, G. REED, and E. C. STAKMAN (*Amer. Jour. Bot.*, 10 (1923), No. 5, pp. 221-228, 229-233, 234-238,

239-244).—In the symposium here presented, the species concept is dealt with by the authors in the order above given from the point of view, respectively, of a geneticist, of a morphologist, of a physiologist and bacteriologist, and of a plant pathologist.

GENETICS

The chemistry of embryonic development, J. NEEDHAM (*Sci. Prog.* [London], 19 (1924), No. 73, pp. 70-85, figs. 6).—This is a scientific review of the metabolism and related chemical changes going on during embryonic development.

Some facts relevant to a discussion of the origin and inheritance of specific characters, F. B. SUMNER (*Amer. Nat.*, 57 (1923), No. 650, pp. 238-254).—This is a discussion of the origin and mode of inheritance of species differences, based largely on the author's investigations with mice of the genus *Peromyscus* at the Scripps Institution for Biological Research.

The evolution of different species by orthogenesis and by natural selection as a result of Mendelian mutations is contrasted, and certain irregularities of each theory are pointed out. The multiple factor theory for explaining the inheritance of quantitative characters in hybridization experiments with species of *Peromyscus* has, in the author's experiments, met with the following difficulties, dealing with the variability of the F_2 populations: (1) Increases in the F_2 variability have related not only to characters in which the parent races differ, but also to characters in which the parent races do not differ; (2) increases in the F_2 variability failed to appear in certain cases where the parent races differ widely; and (3) the F_2 increase in variability has possibly occurred most consistently in a series of characters (indices of bilateral asymmetry) which have been shown not to be hereditary. An appeal is made for the general collection of more data bringing out the differences of species with reference to their geographical distribution.

Some observations on the inheritance of color in the case of fowls [trans. title], S. KOPEĆ (*Pam. Państw. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*, 3 (1922), A, pp. 328-342).—The author graded the eggs of three pullets laying a cream colored egg, when mated to a rooster of their own breed, according to a color scheme varying from 1 to 8, and found these eggs to have an average grade of 7.1. When the same birds were mated with a Leghorn rooster the color of the eggs was much lighter, averaging 5.4, thus tending to be intermediate in color between the two breeds, the eggs of Leghorns averaging 1.5. The eggs of the F_1 females produced from this cross when mated to an F_1 male were lighter in color than the eggs from which they were hatched, averaging 3.3, but not as light as Leghorn eggs. The averages of the color of eggs laid by F_2 females unmated were distinctly different for the different birds, varying from 1.4 to 7.2 as the averages for individuals.

Genes for the extension of black pigment in the chicken, W. A. LIPPINCOTT (*Amer. Nat.*, 57 (1923), No. 650, pp. 284-287).—In experiments at the Kansas Experiment Station, the author has confirmed the operation of the factor E^m for the extension of black pigment previously described by Dunn (*E. S. R.*, 50, p. 227). This factor is also shown to be distinct from the factor E involved in the heredity of blue in Andalusian fowls. Further experiments have suggested the probable operation of a number of genes for the extension of black in the chicken.

Variations of linkage in rats and mice, W. E. CASTLE and W. L. WACHTER (*Genetics*, 9 (1924), No. 1, pp. 1-12).—The results of a study dealing with factors affecting variations in the amount of crossing-over between the genes

c, *r*, and *p* for albinism, red-eyed yellow, and pink-eyed yellow, respectively, in rats are reported from the Bussey Institution. Similar results are reported for albinism and pink-eyed factors in mice. The following table gives a summary based on several thousand individuals of the amount of crossing-over occurring between the different factors in males and females of rats and mice:

Crossing-over in rats and mice

Factors involved	Females	Males	Average
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Albinism and red-eyed yellow in rats.....	0.53±0.78	0.18±0.50	0.28±0.42
Red-eyed yellow and pink-eyed yellow in rats.....	20.46±.92	15.55±1.04	18.33±.69
Albinism and pink-eyed yellow in rats.....	21.93±.44	18.39±.32	19.66±.26
Albinism and pink-eyed yellow in mice.....	16.44±.82	13.77±.57	14.63±.47

In both rats and mice a greater amount of crossing-over occurred in females than in males, and in both sexes the sum of the intermediate crossovers (*c* and *r*, and *r* and *p*) is approximately equal to the amount of crossing-over occurring between the two most distant genes in the rat (*c* and *p*). No other conditions were associated with significant differences in the amount of crossing-over occurring. Considerable deviations from the average were shown by individual parents, but this condition was found not to be hereditary and is attributed to chance. The age of the parents, temperature, and season had no influence on the crossing-over. Some indication of a rise in the crossing-over percentages in litters born during July, August, and September was, however, pointed out by the authors.

An effect of X rays on the linkage of Mendelian characters in the second chromosome of *Drosophila melanogaster*, J. W. MAVOR and H. K. SVENSON (*Genetics*, 9 (1924), No. 1, pp. 70-89, figs. 9).—This is a more detailed account of the results of the experiments previously noted (E. S. R., 51, p. 230).

Crossingover in the second chromosome of *Drosophila melanogaster* in the F₁ generation of X-rayed females, J. W. MAVOR and H. K. SVENSON (*Amer. Nat.*, 58 (1924), No. 657, pp. 311-315).—The results of a test of the crossing-over occurring in the offspring of the X-rayed flies noted in the above paper are reported. In making this test, females heterozygous for the characters black, purple, and curved located in the second chromosome were mated with homozygous recessive males. The flies taken from the control experiment and mated in this way showed an average of 3.72 per cent of crossing-over between the characters black and purple and 13.07 per cent between the character purple and curved. The females from the X-rayed stock showed average crossover percentages between black and purple of 3.86 per cent and between purple and curved of 13.29 per cent. The only significant differences between the offspring of the control and X-rayed flies were that in the first flies emerging the crossover percentages between purple and curved were 17.58, whereas the second flies from the X-rayed stock showed crossing-over percentages of 9.88 per cent. The crossing-over in the first and second groups of control flies was 11.64 and 14.01 per cent, respectively.

The authors, however, believe that these differences are not significant, and conclude that the effect of X-rays on crossing-over in the second chromosome is probably not transmitted and certainly not with the same intensity.

A case of complete sex-reversal in the adult pigeon, O. RIDDLE (*Amer. Nat.*, 58 (1924), No. 655, pp. 167-181, fig. 1).—Complete reversal of sex in a pigeon at the Carnegie Station for Experimental Evolution is described. This pigeon laid eggs in 1914 from which young were hatched, but later developed

tuberculosis of the ovary and ceased to lay, but continued to incubate willingly the eggs of other birds. Later it began to copulate as a male and cooed as a male. At the time of death testicles were observed, and due to an oversight, it was considered as a normal male except for the tuberculosis. The similarity between this case and that of sex reversal described by Crew (E. S. R., 50, p. 530) is noted, and comparisons are made.

The author's conclusion as to the hypothesis explaining sex reversal, as well as many hermaphrodites, is based on the rate of metabolism. Earlier studies have shown that conditions tending to increase the metabolism tend to carry sex development in the male direction, and it has also been shown that the metabolic rate increases in tubercular individuals as was also indicated by the live weights in the case of the pigeon in question.

The development of the reproductive ducts and canals in the free-martin with comparison of the normal, T. H. BISSENETTE (*Amer. Jour. Anat.*, 33 (1924), No. 2, pp. 267-345, figs. 24).—In a study at the University of Chicago of the development of the genital organs in 35 cattle embryos, some of which were freemartins, it was found that in the freemartin the genitalia of mesodermal origin start to develop as females, but later, as the sex hormone of the male twin, as was previously suggested by Lillie (E. S. R., 40, p. 446), is secreted, some of the strictly female organs either degenerate or cease development and growth continues in the male direction. No effect on the external genitalia were observed in any of the freemartins.

The induction of a sexually mature condition in immature females by injection of the ovarian follicular hormone, E. ALLEN and E. A. DOISY (*Amer. Jour. Physiol.*, 69 (1924), No. 3, pp. 577-588, figs. 12).—In several series of experiments conducted cooperatively at the Washington University School of Medicine, University of Missouri, and the St. Louis University School of Medicine, it was found that from four to six injections of the contents of ovarian follicles of the sow in advanced stages of development caused the occurrence of oestrus within 2 to 3 days in both spayed and normal but immature rats. Puberty was thus attained from 20 to 50 days earlier than usual.

Due to the parallelism in the development of the secondary sex characters and the genital organs and the inconstancy of typical interstitial tissue in the immature ovaries of several species, it is suggested that the follicular hormone may also be responsible for the development of secondary sex characters.

Some effects of unilateral ovariectomy in rabbits, S. A. ASDELL (*Brit. Jour. Expt. Biol.*, 1 (1924), No. 4, pp. 473-486).—The effect of the removal of one ovary or one ovary and from one-third to two-thirds of the other on fertility, fecundity, fetal atrophy, and sex ratio in rabbits has been studied at the Institute of Animal Nutrition at Cambridge. The animals used consisted of three groups which at the time of removing the ovarian tissue were 22, 18 to 20, and 15 to 19 weeks old, respectively. In the last named group, in addition to the removal of one ovary, from one-third to two-thirds of the other was also cut away. The Fallopian tube on the side of the ovary entirely removed was ligatured in all operated does. Does of similar age and breeding were used as controls. Both the operated and the control does were killed on the twentieth day of their fourth pregnancy.

The results of the experiments showed that the average sizes of the litters born to the operated and control does, respectively, in the three groups were 7.1 ± 0.5 and 7.5 ± 0.4 , 7 ± 0.4 and 8.7 ± 0.7 , and 6.2 ± 0.3 and 7.5 ± 0.4 . The reduction in the litter size, with the removal of a single ovary in the two groups, was thus 5.3 and 19.5 per cent, and 17.3 per cent when portions of the other ovary were also removed. As determined by the number of corpora lutea found, the removal of one ovary had no effect on the number of

ova discharged, while with the removal of all of one ovary and part of the other the number of ova discharged was reduced from 13 ± 0.6 to 10.3 ± 0.5 . The removal of ovarian tissue increased the average fetuses atrophied per litter from 0.4 ± 0.1 to 1.4 ± 0.1 . It is suggested that the increase in fetal atrophy may be due to the traumatic dangers associated with the crowding of the fetuses in one cornu rather than to the direct effect of the crowding.

A distinct hypertrophy of the remaining ovarian tissue in the operated animals was found to have occurred, but no hypertrophy of interstitial cells was evident. The removal of one or the other ovary did not disturb the sex ratio. Cases of the migration of ova from the ovary of one side to the tube on the other side were observed. Since the uterus of the rabbit is bipartite, the migration must have occurred through the peritoneal cavity.

Cytological changes in unfertilized tubal eggs of the rat, M. C. MANN (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 46 (1924), No. 6, pp. 316-327*).—A cytological study at the University of California of 252 ova found in 50 oviducts of rats which had not been allowed to mate with males showed that the usual tendency of unfertilized eggs is to degenerate in a more or less regular manner rather than to continue to develop parthenogenetically as has been suggested. A few 2, 3, and 4 cell stages were found, but these were most certainly exceptions.

On parthenogenetic cleavage and on the rôle of water absorption by the ovum in the formation of the subgerminal cavity in the pigeon's egg, G. W. BARTELMIZ and O. RIDDLE (*Amer. Jour. Anat., 33 (1924), No. 1, pp. 57-66, figs. 2*).—In studies conducted cooperatively from the University of Chicago and the Carnegie Station for Experimental Evolution, it was found that the early cleavage stages occur parthenogenetically in incubated but unfertilized pigeon's egg. The development, however, ceases at a point corresponding in the fertilized egg to about 10 hours of normal development, thus stopping before the formation of the subgerminal cavity. A similar condition is found in the parthenogenetically developed eggs, and has been attributed to an increase in the water content of the yolk by osmosis from the albumin. The percentage of water in the yolk of the eggs of several birds is shown to have increased from the time the ova were discharged from the ovary until from 4 to 9 days of incubation. The increases in the water content were observed in all places in the yolk, but the rate of increase was rapidly becoming greater toward the latter part of the period mentioned.

Hereditary structural defects in the descendants of mice exposed to Roentgen ray irradiation, H. J. BAGG and C. C. LITTLE (*Amer. Jour. Anat., 33 (1924), No. 1, pp. 119-145, figs. 14*).—In investigations with mice at the Cornell University Medical College and at the University of Maine, individuals with abnormal eyes, ears, or clubfeet have occurred in the third and later generation descendants from a group of individuals treated for 12 seconds on 5 successive days with unfiltered X-rays. The conditions of treatment were target skin distance 12 in., 2.5-in. spark gap, and 10 milliamperes current. The abnormal individuals resulted from two different matings.

The eye abnormalities were most common, but varied in character from an atrophy of the eyelids to an atrophy of one or both eyes, accompanied by a deformity of the skull. The diminution of the ear size or clubfeet or both frequently occurred in the animals having defective eyes. The average litter size of the mice in the lines producing the eye abnormalities was 5.15 as compared with 7 for the controls. Many females from the abnormal lines were killed when pregnant, and it was found that many of the embryos and in some cases all from certain litters showed characteristic subcutaneous

hemorrhagic lesions, mainly on the head and adjoining regions. This condition is thought to account for the occurrence of the abnormal eyes and ears and possibly for the clubfeet through injury to the nervous system, as the eye abnormalities and those on the feet and ears were usually on the same side of the body. No such abnormalities have ever occurred in over 2,000 animals produced by inbreeding from another portion of the same stock which was not X-rayed.

FIELD CROPS

[Field crops work at St. Vincent, 1921 and 1922], F. WATTS ET AL. (*West Indies Imp. Dept. Agr., St. Vincent Agr. Dept. Rpts. 1921, pp. 4-15, 27-33; 1922, pp. 3-20, 27-33, fig. 1*).—Experiments made in continuation of earlier studies (E. S. R., 47, p. 632) included variety tests with sugar cane, yams, sweet potatoes, and cassava; fertilizer trials with cotton, corn, peanuts, and sugar cane; comparisons of legumes for green manuring; seeding and topping tests with cassava; and spacing tests and studies of inheritance of lint length and of pure lines and selections of cotton. Industrial work with field crops is reviewed.

In fertilizer experiments with Sea Island cotton from 1912 to 1921, inclusive, the average acre yields of seed cotton from untreated plats amounted to 603 lbs., plats fertilized with nitrogen 685, phosphate 671, potash 826, phosphate and potash 711, nitrogen, phosphate, and potash 758, cottonseed meal 666, and cottonseed meal, phosphate, and potash 841 lbs. In cotton investigations reported on by T. G. Mason, the development of the vegetative branches of cotton appeared to be inimical to the production of fruit on the fruiting branches of the central axis of the plant. Observations on the spacing of cotton suggest that the plants should be spaced as close as is compatible with proper access to light, and that the vegetative branches may be suppressed by drilling and deferring thinning until from five to six weeks after seeding.

Shedding experiments (E. S. R., 48, p. 438) led to conclusions that while a small proportion of shedding is inevitable, it is excessive in St. Vincent because of disease and physiological reasons. The principal disease causing shedding is said to be bacterial boll rot (*Bacterium malvacearum*.) Physiological shedding in St. Vincent is due mainly to a check in the assimilative activity of the leaves and not to root asphyxiation. Boll dropping would apparently be considerably reduced by deferring planting until late in August. It was thought that topping the plant at the right time should hasten the crop and reduce shedding, but in topping tests by L. H. Burd the increase due to the practice were scarcely of practical value.

[Field crops experiments in Bihar and Orissa, 1921-22 and 1922-23], A. C. DOBBS ET AL. (*Bihar and Orissa Agr. Dept. Rpts. 1922, pp. 3, 4, 11, 16, 17, 18, 19; 1923, pp. 4-7, 12, 15, 16, 20-22, 25, 26*).—These pages describe the continuation of investigations with field crops (E. S. R., 46, p. 831) in different localities in Bihar and Orissa.

[Field crops work in Punjab, India], D. MILNE ET AL. (*Punjab Dept. Agr. Rpt. 1923, pt. 1, pp. 6-15, 18-20, VII-XVI, pl. 1*).—The progress is described of work noted earlier (E. S. R., 51, p. 137).

The relation of after-ripening conditions to the germination of cereals [trans. title], G. GASSNER (*Mitt. Deut. Landw. Gesell., 39 (1924), No. 12, pp. 209-211*).—Germination studies made on samples of Schlanstedt spring wheat of different stages of maturity and of after-ripening, and from crops grown in different years, gave indications that warm dry weather produces seed

characterized by more rapid after-ripening than seed approaching maturity under lower temperatures and unfavorable weather conditions. Increasingly unfavorable weather conditions up to the time of harvest and maturity appear to be accompanied by poorer germ maturity of the seed at harvest and slower attainment of complete germ maturity in the following month.

The seasonal productivity of herbage grasses with particular reference to the influence of different systems of cutting on indigenous and non-indigenous strains, respectively, R. G. STAPLEDON (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. H, No. 3 (1920-23), pp. 5-84, figs. 13*).—Investigations at Aberystwyth, Wales, during the period 1920-1923, concerning yield and the factors affecting yield in relation to different species, nationalities, and strains of grasses, are described in detail, supplementing an earlier account (E. S. R., 47, p. 226). The principal findings and observations as reinforced by the results of contemporaries may be summarized as follows:

Under normal conditions most grass species if grown in pure cultures will probably yield their heaviest crops in the first harvest year, meadow foxtail, red fescue, crested dog's-tail, and smooth stalked meadow grass appearing to be definite exceptions. The relation of the yield in the first harvest year to subsequent harvest years is influenced largely by the weather conditions in the first two harvest years. The hay yield in any particular year is affected considerably by the meteorological conditions. The yield of aftermath in any one year is affected largely by the meteorological conditions during a period from about a week before cutting the hay until cutting the aftermath, and apparently also by the size of the hay crop. Very heavy crops of hay and aftermath in the same season may be regarded as exceptional. The yields of hay and aftermath are influenced to a very considerable extent by the date of the last cutting for hay. Late cutting, although compatible with heavy yields of hay, occasions reduced aftermaths.

The seasonal productivity of pastures as illustrated by a rather lenient system of pasture cuts (a system giving effects analogous to grazing and providing essentially that the cuts follow each other at regular intervals and that the first cut be made before flowering) is affected as much or more by the functional periodicity of the plants as by meteorological conditions. The growth in any one incremental period is affected more by the meteorological conditions in the immediately preceding period or periods than by those in the current period. The heaviest gross yields can be obtained when the first cut is taken as hay at the flowering period and is followed by two aftermath cuts. The amount of extra yield obtainable from one or two aftermath cuts in addition to hay will depend upon the season.

In general, exotic strains compare best with indigenous when judged by a system of pasture cuts varying from about 5 to 7 per growing season, and least when judged by a drastic system of pasture cuts, 13 to 17. The capacity to be productive under pasture cuts is thought to depend on a plant's ability to revive and grow quickly after each cut and to withstand the adverse physiological conditions occasioned by repeated cutting. The disparity between the yields from systems with few cuts and many cuts becomes even more exaggerated in proportion as the conditions are unfavorable during the growing season. The date at which a system of pasture cuts is initiated has a profound influence on the gross yield obtainable from such a system. A system started when the plants have attained full heading will outyield one started earlier. Cutting to a 2-in. level instead of to the ground made for an increase in the gross produce from a system of seven pasture cuts.

The percentage of leaf in total produce is lowest in the hay and highest in

the aftermath and under a system of pasture cuts. The percentage of leaf in the aggregate produce from the system tends to increase as the number of pasture cuts is increased. The amount of leaf developed in a hay and aftermath crop tends, however, to be more than under a system of pasture cuts, while the gross yield of leaf is greater from a system of relatively few than from one of many pasture cuts. Under drastic systems of cutting, indigenous strains tend to give rather higher percentages of leaf than exotics.

The percentage of dry matter in total green fodder is at its highest in the hay and is very similar in aftermath to that in the average of a number of pasture cuts taken throughout the season. The percentage of dry matter in the total aggregate produce of pasture cuts is higher when the number of cuts is comparatively few. The percentage of dry matter in green fodder, like gross yield and the stem to leaf ratio, appears to be affected by the functional periodicity of the plants as much as or more than by meteorological conditions.

Where the first cut is made before heading, cutting grasses more often than four times per season results in a proportional reduction in the development of the root system and tillers by the end of the season. This reduction is revealed by diminished yield throughout the next season and, when the initial cutting system has been particularly drastic, into the spring of the second season or third harvest year. The effect of drastic pretreatment is similar in its qualitative influence to the effect of repeated cutting shown during the season of application. Indigenous strains of orchard grass, particularly dense-pasture types, appeared to be most resistant to drastic pretreatments, while both dense-pasture and tussocks were notably more resistant under drastic and intermediate treatments than Danish and U. S. A. strains.

Exotic strains of grasses tended to give the heaviest yields rather early in the spring and in the autumn of the seeding year, while indigenous were inclined to excel in the later summer and autumn. The indigenous strains seem to produce a more leafy herbage than the nonindigenous, notably in the hay. Orchard grass, sweet vernal grass, and tall fescue appear to be particularly leafy grasses in hay, aftermath, and pasture alike, whereas tall oat grass (French), crested dog's-tail, and golden oat grass appear to be among the least leafy grasses. Following pasture cuts in both the first and second harvest years, the number of tillers per unit of area at the end of a second harvest year tends to be far greater in indigenous than in exotic strains. Based on results during two harvest years, the highest yielding of the grasses tested in pure cultures, considering hay, aftermath, and pasture, seem to be orchard grass, tall oat grass, tall and meadow fescue, timothy, perennial rye grass, and meadow foxtail; intermediates, golden oat grass, sweet vernal grass, and *Poa serotina*; and lowest, red fescue and crested dog's-tail, with probably rough and smooth stalked meadow grasses.

Alfalfa production for New York, L. A. DALTON (*N. Y. Agr. Col. (Cornell) Ext. Bul. 84 (1924), pp. 21, figs. 11*).—Practical information is offered for growing alfalfa under conditions in New York.

A note on subterranean clover (Australian variety), R. D. WILLIAMS and W. DAVIES (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. H. No. 3 (1920-23), pp. 151-158, fig. 1*).—According to results of experiments at Aberystwyth, Wales, subterranean clover is to be regarded as a typical winter annual. The seeds are of high average viability, germinate well and quickly in the soil, and have a rather long seasonal range of establishment. This clover has an exceptional ability for establishment from self-seeding. Plants which have not flowered to any appreciable extent, and even seedlings, are said to be remarkably winter resistant, whereas plants that have flowered freely, even if too late to set and ripen seed, are soon eliminated by winter

frosts. It is considered particularly valuable as a catch crop and in mixtures for temporary meadows.

Crimson clover: Seed production, J. M. WESTGATE, rev. by A. J. PIETERS (*U. S. Dept. Agr. Farmers' Bul.*, 1411 (1924), pp. 12, figs. 9).—This revision of Farmers' Bulletin 646 (E. S. R., 32, p. 732) is intended primarily for the eastern part of the United States south of Pennsylvania.

The productivity of different strains and nationalities of red clover under hay and pasture conditions (represented by eight monthly pasture cuts), R. D. WILLIAMS (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. H, No. 3 (1920-23), pp. 131-150, figs. 5*).—In comparative trials at Aberystwyth, Wales (E. S. R., 47, p. 226), the late strains of red clover produced much heavier hay crops than any of the early strains. Of the late strains, Swedish, American mammoth, and Cornish Marl gave the heaviest hay yields, and the Vale of Clwyd, Bohemian, and English were the most productive of the intermediate and early strains. Italian made an exceedingly poor hay crop, only about one-sixth of that yielded by Swedish late, whereas wild red clover yielded slightly more hay than the average given by the early strains. The green hay of wild red contained a higher percentage of dry matter than any of the commercial strains, and the green hay of the late strains averaged 2.36 per cent more dry matter than that of the early strains. The average weights of leaves in the hay from early and late strains amounted to 52.84 and 39.36 per cent, respectively. Because of the greater amounts of hay produced by the late strains, they gave a much greater weight of leaves per unit area. The late strains developed more flower heads than the early strains, and the wild red flowered even more freely than the late strains.

Under conditions approximating close grazing, the early strains were again excelled by most of the late strains, but the superiority of the late over the early strains was not so pronounced under pasture cutting conditions as when cut for hay. Of the late strains, Swedish, Montgomeryshire late, and Cornish Marl gave the best results, and of the intermediate and early strains, Vale of Clwyd, Bohemian, English, and American medium were much superior to Chilian, Brittany, and Italian. Wild red equaled the poor late strains and the best early strains. During the winter and early spring of the seeding year and autumn of the first harvest year the pasturage afforded by wild red was practically negligible, and during these periods the best early strains made much more growth than the late strains, with the exception of Swedish late. The maximum growth occurred during June and July, when from 48.4 to 57.4 per cent of the total pasture yields for the 12 months were obtained. A more or less definite negative correlation was observed in each strain between the weights yielded by the monthly pasture cuts and the percentage of dry matter of the monthly produce. March and April cuts, which gave the poorest yields, had the highest percentage of dry matter. As the yields increased during May, June, and July the percentage of dry matter decreased more or less correspondingly, and as the yields decreased during August and September the percentage of dry matter again rose. The productivity and the percentage of dry matter in the aggregate pasture yields of the different strains were closely related. The most productive strains had the lowest percentage of dry matter and vice versa.

The aggregate pasture cuts of the late strains were slightly more leafy than those of the early strains. Wild red clover was decidedly more stemmy than any of the commercial strains. In all strains the pasture produce was more leafy during the spring, early summer, and autumn than during midsummer. When cut four times during the growing season, the late strains yielded 69.1

per cent and the early strains 58.5 per cent of the amount taken as a hay cut, but when cut eight times the ratios between the aggregate pasture cuts and the hay yields of the late, early, and wild red strains were only 23, 33.2, and 30.7 per cent, respectively. Apparently red clover can not withstand repeated close cutting, and it would seem to be more essentially a hay than a pasture plant. The percentage of dry matter in green hay ranged from 16.7 to 21.2 per cent, according to strain, while the dry matter content of the pasture cuts varied from 13.9 to 17 per cent.

Corn growers face worst seed shortage in years, J. C. HACKLEMAN (*Illinois Sta. Circ.* 292 (1924), pp. 4, figs. 4).—In calling attention to a possible seed corn shortage in Illinois, the author urges corn growers to choose sound ears from healthy standing stalks, preferably early, and to gather more than needed for their own farms. Well-ventilated storage is essential.

Culture of Pima and upland cotton in Arizona, O. F. COOK and R. D. MARTIN (*U. S. Dept. Agr. Farmers' Bul.* 1432 (1924), pp. II+14, figs. 6).—This publication, which describes the methods used in growing cotton in the Salt River Valley, Ariz., including selection and preparation of the land, planting, thinning, irrigation, cultivation, and the harvesting and ginning of the crop, is largely a revision of Farmers' Bulletin 577 (E. S. R., 31, p. 41), and of material from other Departmental publications.

Delfos cotton (*Mississippi Sta. Circ.* 52 (1924), pp. 6).—This circular describes the origin, characteristics, and behavior in recent tests in Mississippi of Delfos 631 and Delfos 6102 cotton. The name "Delfos" designates certain strains selected from Foster cotton at the Delta Substation (E. S. R., 49, p. 225).

Ratoon cotton, S. C. HARLAND (*Trop. Agr. [Trinidad]*, 1 (1924), No. 7, pp. 101, 102).—In describing the behavior of upland cotton when grown in frostless regions, the author states that, where environmental conditions favor continuous fruiting with little or no rest period, insect pests and fungus diseases will be favored unduly and the quality of the cotton will be inferior. He has observed that ratoon upland plants seldom have the vegetative vigor needed to insure good thickening of the lint fibers. Only under exceptional conditions will the quality of the ratoon cotton from upland plants grown in the Tropics be up to the standard required by the spinner from good grades of American cotton.

Microscopic examination of the second and third year plants reveals that the quality of the staple is no worse and is often better than that produced in the first year, indicating that the quality of ratoon cotton depends on the breed of cotton grown and that bad quality is not a necessary corollary of ratooning. Comparison between a West Indian cotton which tolerates ratooning without deterioration and upland cotton indicates that deterioration of quality in ratoon cotton can be avoided only by supplying a type of plant the vegetative vigor of which is provided for by extensive vegetative zones, i. e., by growing monopodial or perennial types. The monopodial habit may be combined with lint of practically any desired quality by hybridizing perennial types among themselves.

Each tropical cotton-growing country will have to decide whether insect pests are present which prevent the growth of perennial cotton. In the West Indies, leaf blister mite effectually prevents the ratooning of Sea Island cotton, but the perennial types are immune to this pest. Neither pink bollworm nor cotton stainers are to be feared if the fields are cleaned up at the end of the season.

Experimental work on cotton, 1922, E. SHEARER ET AL. (*Egypt Min. Agr., Cotton Research Bd. Ann. Rpt.*, 3 (1922), pp. 11-27, 41-59, 83-95, pls. 4).—Agronomic investigations carried on with cotton in Egypt in 1922 under the

auspices of the Cotton Research Board in continuation of earlier work (E. S. R., 49, p. 131) comprised extraction of pure lines; selection and propagation of selected strains; hybridization; studies on vicinism, bud and boll shedding, growth, flowering, pollen grains, and the root system; observations on the effect of heat and of soaking in water on cotton seed; variety trials; and rotation and irrigation tests. Preliminary electrocultural experiments and treatment of seed with electricity and with "Fertilisa" before sowing gave unsatisfactory results. Summaries of publications relating to cotton in Egypt are included, with a brief account of Sea Island cotton in Egypt.

Cotton culture in western Madagascar [trans. title], REYNIER (*Madagascar Bul. Écon.*, 20 (1923), III-IV, No. 3-4, pp. 159-176, pl. 1).—A report on the possibilities of cotton production in the western part of Madagascar.

[Report of the work of] the **British Cotton Growing Association** (*Brit. Cotton Growing Assoc. [Pub.]* 83 (1924), pp. 43, pls. 8).—The status of the cotton industry in the British colonies and possessions is reported in summary form for the year 1923.

On the occurrence and distribution of *Festuca rubra* Hack. in Great Britain, W. O. HOWARTH (*Jour. Linn. Soc. [London], Bot.*, 46 (1924), No. 309, pp. 313-331, pls. 5).—The characteristics, botanical relationship, and distribution in Great Britain of *F. rubra* and its subspecies and varieties are discussed in detail.

Some tentative statements concerning Fowlds Hullless oats, A. N. HUME (*South Dakota Sta. Bul.* 205 (1924), pp. 613-627, figs. 2).—In preliminary trials, Fowlds Hull-less oats yielded fewer bushels per acre than the best standard varieties of oats, even when the latter were reduced to the hull-less basis. Analyses by A. L. Bushey showed samples of hull-less oats to contain more raw protein than the whole grain of ordinary varieties, but less than the kernels of the same varieties. The higher-yielding varieties of ordinary oats produced more raw protein per acre than hull-less oats, either on a basis of the whole grains or of kernels. A superior resistance to lodging is not indicated. The results at Brookings in 1923 suggest using hull-less oats as a special feed for young animals rather than as a general farm crop for all conditions.

Records of the annual precipitation at the station and substations are appended.

How to grow rice in the Sacramento Valley, J. W. JONES (*U. S. Dept. Agr. Farmers' Bul.* 1240 (1924), pp. II+27, figs. 6).—This publication supercedes Farmers' Bulletin 1141 (E. S. R., 44, p. 529). A more complete discussion of rice production in California, together with the details of the experiments on which many of the recommendations are based, has been noted (E. S. R., 49, p. 433).

The Uba cane (*La. Planter*, 73 (1924), No. 1, pp. 2, 3).—It is reported that results obtained in Australia by E. Young showed Uba sugar cane to have a high fiber content, to be hard to crush, and severe on mill rollers. The refractory nature of the juice and the large amount of wax in the variety hindered the manufacture of sugar. Burning to remove trash, which is accompanied by a certain loss of sucrose, seems almost necessary. A report on South African sugar manufacturing by Maxwell is also referred to, in which he states that the juice from Uba cane is refractory and advocates double carbonation for making white sugars, an expensive process requiring much additional machinery. He also states that reliance on Uba cane is a handicap of from 15 to 20 per cent. These experiences seem to confirm past investigations made at the Louisiana Sugar Experiment Station on Japanese types of cane wherein the gummy nature of the juice of this cane was found quite objectionable in sugar manufacture.

Factors which influence the nicotine content of tobacco grown for use as an insecticide, R. W. THATCHER, L. R. STREETER, and R. C. COLLISON (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 7, pp. 459-466).—Investigations at the New York State Experiment Station gave indications that under identical conditions *Nicotiana rustica* develops a nicotine content about three times as large as do common strains of *N. tabacum*, this agreeing with the findings of Juritz (*E. S. R.*, 48, p. 231) and W. W. Garner.

Comparisons of different stocks of Pryor tobacco suggest that local environmental factors during growth are likely to be more potent than the source of the seed in determining the nicotine content of any given variety of *N. tabacum*. While seeding the crop broadcast without summer cultivation might be more economical than in cultivated rows in growing the crop for insecticide use, broadcasting so reduced the nicotine content of the tobacco as to render the practice inadvisable.

Seasonal conditions during growth exerted a very marked effect upon the nicotine content of the tobacco and upon the maturity of the plants at harvest time with *N. rustica* grown at the station in 1923. Warm weather, favoring rapid growth and early maturity, very evidently produced increased percentages of nicotine in the tobacco. Some effect of the varying soil treatments upon the nicotine content of the tobacco was noticeable, but this was slight compared with the seasonal or climatic influence. The possibility is suggested of selecting plants with high nicotine content as parent stocks for tobacco intended for insecticide use, particularly from a strain of *N. rustica* which shows great variation between individual plants.

A method of detecting mixtures in Kanred wheat seed, C. O. JOHNSTON and C. W. BOWER (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 7, pp. 467-470).—Effective use has been made of the differential reaction of Kanred and other varieties of hard red winter wheat to certain specialized races or strains of stem rust (*Puccinia graminis tritici*) to distinguish Kanred from other related varieties. Results in experiments at the Kansas Experiment Station show that the rust test applied to seedlings is a good index of the purity of Kanred seed wheat, is rapid and accurate, and should prove a valuable supplement to field inspection. With proper specialized forms of stem rust, the method also could be used for Marquis, Kota, and several of the durum wheats. Leaf rust of wheat might be used for similar tests to detect mixtures in certain strains of Mediterranean, Fulcaster, and other varieties of soft red winter wheat.

HORTICULTURE

A treatise on gardening, J. RANDOLPH, JR. (*Richmond, Va.: William Parks Club*, 1924, pp. XV+54).—This pamphlet, reprinted from the third edition of Gardiner and Hepburn's *American Gardener* (1826), is of historical value only. The original, probably published during the decade 1760-1770, was not only the first Virginian work on cultivation of plants, but also the first gardening manual to be published in America.

Influence of the carbohydrate-nitrate content of cuttings upon the production of roots, C. C. STARRING (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 288-292).—*Tradescantia* and tomato cuttings high and low in carbohydrates, as indicated by starch content and free reducing substances, were obtained in two ways, (1) from plants supplied with complete and nitrate-free nutrient solutions and (2) from plants exposed to different lengths of light. Records of rooting of cuttings planted in river sand, moistened with distilled water, and held in darkness showed a very marked advantage in favor of the high carbo-

hydrate groups. On the other hand, nitrate content appeared to be of little significance, whether accompanied by high or low carbohydrates, leading the author to conclude that the carbohydrate content of cuttings is a very important factor in influencing the production of roots. When tomato cuttings high in carbohydrates and low in nitrogen were rooted in complete and nitrate-free solutions, the average total length of roots in the complete solution was 16.1 cm. and in the nitrate-free solution 22.9 cm., leading the author to suggest that the propagating value of sand may lie in its low nitrate content.

An examination of tradescantia plants high and low in carbohydrates failed to show that rooting at the nodes is due to starch accumulations at these points. In low carbohydrate plants no starch was present in the nodes, and in high carbohydrate plants starch was equally abundant throughout the entire cutting.

The possible relation of anthocyan pigments to summer injury in potatoes and sweet corn, I. C. HOFFMAN (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 188-191).—On the supposition that the larger amount of tipburn injury observed in potato plants having red, blue, or purple color in their tissue than in green colored plants might be associated with higher temperature in the colored tissue, readings were taken with a thermoelectrical apparatus upon dark and light colored sprouts of a single potato variety, resulting in the discovery that the temperature within the purple sprouts was about 20° C. (36° F.) above that within the green sprouts.

Further indication of the effect of color on internal temperature and the welfare of plants was observed in the case of selfed strains of Stowell Evergreen sweet corn which varied in color from pure green to dark purple. At the beginning of the season all the strains started normally, but with the advent of high temperature and drought the purple plants stopped growing and in some cases died, while the pure green plants grew thriftily. Intermediate types apparently suffered in proportion to the amount of purple anthocyan. Determinations of the temperature in the stalks of purple and green plants on a day in which the air temperature was 85° F. showed 90.2° for colored and 83.9° for green stalks. These records were taken, however, in a favorable growing season, and it is thought that under conditions of drought and extreme temperatures wider variations might have been recorded.

Inheritance of "bolting" in cabbage, E. P. F. SUTTON (*Jour. Heredity*, 15 (1924), No. 6, pp. 257-260, figs. 2).—Because of a tendency to form flower stalks prematurely without heading, only a few of the many varieties of cabbage grown in England are suitable for the production of the spring crop, plants for which must lie over winter in the open fields. Years of observation having led the author to believe that this tendency to bolt or form flower stalks may be considered as a Mendelian recessive, an experiment was carried out at Reading, England, in which a green nonbolting variety was crossed with a red bolting variety, with a view to observing the bolting characteristics of the progeny. The F₁ plants were all red in color and all headed. The F₂ generation represented by 48 plants raised from one of the F₁ plants showed the following segregation: Twenty-seven heading reds, 10 bolting reds, 8 heading greens, and 3 bolting greens, a distribution which is deemed by the author to approximate the Mendelian 9:3:3:1 ratio. The author, however, points out that bolting and nonbolting are both subject to seasonal and cultural factors.

Factors influencing early development of seed stalk of celery, H. C. THOMPSON (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 219-224).—Of several factors studied at Cornell University as possible causes for premature seed

stalk development in celery only one, namely, time of planting, was found to play a significant rôle. Plants started in December and January produced seed stalks the following May, June, and July irrespective of various treatments, such as drying, overwatering, close planting, freezing, etc. Since plants held over the winter in the greenhouse failed to develop flower stalks until the following spring, the author believes that the length of day may be a controlling factor in determining the time of the appearance of the stalk.

Studies upon the relative merits of sweet corn varieties for canning purposes and the relation of maturity of corn to the quality of the canned product, C. W. CULPEPPER and C. A. MAGOON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 5, pp. 403-443, figs. 11).—In again discussing work previously reported upon by Magoon (*E. S. R.*, 50, p. 741), the authors present data in greater detail and include an extensive bibliography.

Fruit spur growth and fruit bud production, E. C. AUCHTER and A. L. SCHRADER (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 127-144).—Studies conducted at the Maryland University upon apple trees of known fruiting performance emphasize the importance in fruit-spur investigations of taking into consideration not only the length of the spurs but also the fruiting condition of the tree, namely, whether of annual or biennial bearing habit, and if biennial whether in the on or off season. It was observed that in certain trees there exist a considerable number of permanently nonblossoming spurs, which the authors believe should be grouped separately in order to avoid error in spur classifications.

Records of the performance in 1920 of spurs of an apple tree which in 1919 bore a light to medium crop showed 50, 37, 32, 5, and 1 per cent, respectively, of blossoming in spurs, whose record in 1919 was as follows: (1) Failed to blossom, (2) blossoms removed at pink stage, (3) blossoms removed at full bloom, (4) fruits removed at the June drop, and (5) fruits removed at harvest. The association of fruitfulness with vegetative development was shown in the case of the spurs from which the buds were removed in the pink stage, in that the 37 per cent which bloomed in 1920 also made the longer secondary growth.

In connection with the general study it was observed in biennial trees that terminal and lateral blooming in 1-year wood occurred quite frequently and abundantly in the crop year and rarely in the off year. In 2-year wood a high percentage of spurs bore blossoms in the crop year and practically no bloom in the off year, regardless of the length of terminal wood.

In general conclusion the authors point out that spur growth and fruiting relations which hold for annual bearing varieties and for many of the biennial varieties when they are in certain types of bearing condition do not hold for strictly biennial trees, except that the blossoming spurs which set in the crop year may be those which have made the greater growth in length or diameter during the previous season.

Pot experiments on the manuring of fruit trees, III, T. WALLACE (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1923, pp. 43-57; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 18 (1923-24), pp. 169-185).—A further report (*E. S. R.*, 49, p. 833) upon fertilizer studies with fruits conducted at the Long Ashton Station, England, with a view to ascertaining the effects on the plants and their fruiting capacity of deficiencies in various fertilizing ingredients.

Apple trees from which nitrogen and phosphoric acid had been withheld since the beginning of the test (1921) were later in blooming and leafing in the 1923 season than were trees of the other treatments. Four lots of trees, (1) rain water only, (2) nitrogen omitted, (3) phosphoric acid omitted, and (4) magnesium omitted, lost their leaves prematurely.

Records for 1923 on gooseberry bushes subjected to the same series of fertilizer treatments since 1922 showed the maximum yield on those plants receiving a nutrient solution from which magnesium alone was omitted. Examination of the root systems showed the best development in those bushes receiving the complete nutrients. Plants receiving no phosphoric acid made practically no shoot growth in 1923, and the root systems were small and poorly developed like those of nonnitrogen lots. Results with black currants and strawberries were highly comparable with those of gooseberries, those lots from which nitrogen and phosphoric acid were withheld showing marked loss in vigor and in productivity.

In the case of raspberry tests started in the spring of 1923, records of growth showed the least development in plants receiving no nitrogen. In contrast to the other fruits the absence of calcium apparently was quite deleterious to raspberry growth. Those plants receiving no potash also made a poor growth. As indicated by vigor of foliage and the amount of growth the complete nutrient plants made the most satisfactory development.

Since apple trees in the complete nutrient series had suffered severely from leaf scorch while other trees receiving potash but no nitrogen were unaffected, it was deemed advisable to carry on supplemental studies in which the nitrogen potash ratio was modified and in which a soluble silicate was introduced. A decrease of nitrogen reduced shoot growth and general vigor. The addition of sodium silicate in the complete nutrient series resulted in a very vigorous growth but at the same time increased the amount of leaf scorch. An excess of potash caused a brownness in the center of the leaves. Where the amount of nitrogen in the complete nutrient solution was cut in half the development of leaf scorch was reduced below that of the complete solution. An increase in the proportion of potash was entirely effective in preventing leaf scorch, the trees in such cultures having less scorch than those of the reduced nitrogen pots even in the presence of the soluble silicate.

A proposed key to commercial apples, C. C. CARPENTER and I. B. STAFFORD (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 294-307).—A new key for the identification of apple varieties is offered, based on a few prominent characters, such as flavor, form, shape of the cross section, skin color, flesh color, and the tufting of the carpels.

[Apple fertilizer studies at Craibstone] (*North of Scot. Col. Agr., Guide Expts. Craibstone*, 1924, pp. 38, 39, fig. 1).—Yields for 1922 and 1923 upon apple trees to which manure was applied alone and in various combinations with mineral fertilizers were largest on the plat fertilized with manure and sulphate of potash.

Liquid lime sulphur versus sulphur dust for apple spraying, F. P. CULINAN and C. E. BAKER (*Indiana Sta. Bul.* 283 (1924), pp. 22, figs. 9).—A report upon tests carried out on 144 trees in a commercial apple orchard near Peru, for the purpose of studying the relative efficiency of sprays and dusts applied at the same time and in accordance with standard schedules and programs as means of controlling diseases and insect pests.

In respect to apple scab, better control was obtained with spraying than with dusting. However, in years of light scab infection, the dust was about equally as effective as the sprays. It was found that sprays applied when the blossom buds were showing pink were not so effective in controlling scab as when an additional spray was used at the time the first leaves on the blossom spurs were unfolding.

Insects, such as codling moth and apple and plum curculios, were quite satisfactorily controlled with the sulfur-lead dust. However, in three of

five years better codling moth and curculio control resulted from spraying, and, from an economic viewpoint, dusting proved more expensive than spraying.

Effect of premature harvest of plums and pears, E. L. OVERHOLSER (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 101-107).—In order to study the effect of the time of harvesting on the keeping quality, sugar content, and flavor of plums, fruit of 16 varieties was picked at three stages of maturity, the average date for the latest picking being 17 days after the first. The average sugar content of the first picked fruits was approximately 10 per cent as compared with 16 per cent for those of the final picking. Furthermore, the fruits of the third harvest averaged approximately 45 per cent larger than those of the first harvest and attained an eating quality designated as very good to excellent, while those of the first picking were rated as poor to fair. Fruits of the third harvest kept nearly as long as the earlier picked fruit in 32° F. storage, and the period of marketability following removal from storage was not materially lessened.

Quite similar results were obtained in an experiment with pears harvested at different times and stored at 32 and 36°. Bosc fruits harvested at the usual commercial time and earlier were small, insipid, wilted easily, and failed to develop the rich, russet brown color characteristic of this variety. Hardy and Comice fruits also gained greatly in size, color, and quality when allowed to remain on the trees beyond the usual commercial harvest.

Strawberry production in Florida, E. W. JENKINS and R. T. KELLEY (*Fla. Univ. Agr. Ext. Bul.* 40 (1924), pp. 16, figs. 8).—Practical suggestions are presented for the cultivation and marketing of the strawberry.

Notes on strawberry breeding, G. T. SPINKS (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.* 1923, pp. 117-125; also in *Jour. Bath and West and South. Counties Soc.*, 5. ser., 18 (1923-24), pp. 238-247).—A review of strawberry breeding results at the Long Ashton Station, in which the author points out desirable characters sought for, namely, productivity, earliness or lateness in maturity, size, color, shape, texture and flavor of fruit, vigor of plants, etc., and lists numerous crosses which have been successful or unsuccessful in producing seedlings possessing these specific requirements. Several combinations of parents were discovered which produced an unusual number of high quality seedlings.

The American cranberrybush, G. M. DARROW (*Jour. Heredity*, 15 (1924), No. 6, pp. 242-253, figs. 11).—Along the lines of a previously noted article (E. S. R., 50, p. 836) the author discusses the value and possibilities of an apparently neglected native American fruit usually known as the high bush cranberry, but for which the Indian name, pembina, is suggested as being more distinctive.

Vine cultivation and the wine industry in Jugo-Slavia, L. MARKOFF (*Internat. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 2 (1924), No. 2, pp. 308-324, pls. 16, fig. 1).—A general discussion relating to the history of grape growing in Yugoslavia, the present status of the industry, and the need of improved varieties, equipment, and scientific assistance in the form of experimental stations and skilled workers.

The olive in Morocco [trans. title], J. RUBY (*Agron. Colon.*, 8 (1923), Nos. 62, pp. 33-40; 63, pp. 73-85, pl. 1; 64, pp. 107-116; 65, pp. 141-150; 66, pp. 180-184).—A general discussion of the olive-producing industry in Morocco, taking into consideration varieties, present status of culture, olive oil production, local features in production, and the possibilities of future expansion.

Note on the possibilities of camphor cultivation from Cinnamomum camphora in northern India, S. H. HOWARD, W. A. ROBERTSON, and J. L.

SIMONSEN (*Indian Forest Rec.*, 9 (1923), No. 7, pp. 34, pls. 6, fig. 1).—Records of production of leaves of coppiced camphor bushes at Dehra Dun indicated that there was little difference in the yield of leaves and resulting camphor whether the plants were clipped two or four times during a single season. Finding that the maturer leaves contain slightly more camphor, the authors believe that the best results may be obtained by making three cuttings, June, September, and December. The propagation, culture, distillation, and economic considerations are briefly discussed.

Some notes on nut growing in the northern United States, H. SPENCE (*Jour. Pomol. and Hort. Sci.*, 4 (1924), No. 1, pp. 1-23, pls. 10).—This general discussion based largely upon current literature deals with nut growing throughout the United States, treating in particular of the Persian walnut in California.

Flowers every day in the year, N. E. HANSEN (*South Dakota Sta. Bul.* 208 (1924), pp. 675-690, figs. 15).—Brief comments are presented on the culture and use of numerous annual and perennial flowering plants which have shown their value for South Dakota conditions.

Breeding ornamental Hibiscus.—II, Artificial and natural selection for dwarf, medium, and tall seedlings, N. B. MENDIOLA and J. O. UNITE (*Philippine Agr.*, 13 (1924), No. 1, pp. 45-47, pl. 1).—Following an earlier report (E. S. R., 49, p. 238) relating to the technique of breeding Hibiscus and describing various seedlings, this brief article discusses variability in the size of seedlings. Certain plants were found dwarfed and lacking in the vigor characterizing normal plants, but when potted separately, they thrived and flowered abundantly. When left in the plat with taller plants the dwarfs soon succumbed, apparently unable to cope with conditions which favored the taller plants. Since dwarf plants are more desirable as potted ornamentals than the tall growing forms, the authors suggest the advisability of separating dwarfs from tall plants and giving them the benefit of more favorable environment.

Color control in forcing hydrangeas, C. H. CONNORS (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 282-288).—In continuation of earlier studies at the New Jersey Experiment Stations (E. S. R., 48, p. 140), in which it was demonstrated that the color of hydrangea blossoms may be influenced by lime applications to the soil, the author determined the H-ion concentration in several natural and prepared soils in which hydrangeas were growing and found a more or less definite relationship between the soil reaction and the flower color. Plants growing in soils having a pH value of 5 or higher consistently produced blue blossoms, while those growing in soils of pH 6.6 or lower consistently produced pink flowers. Between the two values there occurred a number of intermediate colors.

Color observations on plants of the Souvenir de Mme. E. Chautard variety potted in soils containing 0, 2,000, 4,000, 10,000, 20,000, and 40,000 lbs. of ground limestone per acre (6 in. in depth) showed blue flowers in the control and the 2,000-lb. lots, intermediate colors in the 4,000-lb. lot, and pink in all the other lots. The addition of well rotted and sifted manure to soils receiving 20,000 lbs. of limestone apparently hastened the reduction of the limestone as lower pH values were found in such soils. Furthermore, while no injury was observed with 40,000 lbs. of limestone alone, some lime injury was noted where the manure was added to 20,000 lbs.

A preliminary attempt to determine the pH value of flower juices showed an apparent correlation between the pH value of the soil and that of the flower, within the limits of a single variety.

A handbook of garden irises, W. R. DYKES (*London: Martin Hopkinson & Co., Ltd.*, 1924, pp. XI+250, pls. 24).—A compilation, designed primarily for

the practical gardener, of descriptive, historical, and cultural information on species, hybrids, and varieties of irises, common and rare, grown in the garden.

Rhododendrons and the various hybrids, J. G. MILLAIS (*London and New York: Longmans, Green & Co., 1924, 2. ser., pp. XII+264, pls. 53*).—An elaborately prepared monograph on the rhododendron, in which, as in the earlier edition (E. S. R., 38, p. 542), many of the species are illustrated in color. New introductions resulting from recent explorations in the Orient are incorporated for the first time.

Roses and how to grow them, rev. by J. H. MCFARLAND (*Garden City, N. Y.: Doubleday, Page & Co., rev. ed., pp. IX+151, pls. 8, figs. 3*).—This completely revised edition of a previously noted work (E. S. R., 17, p. 770) deals in a thorough manner with the culture of roses and the selection of varieties for different climatic environments, etc.

A little book of climbing plants, A. C. HOTTES (*New York: A. T. De La Mare Co., Inc., 1924, pp. 250, figs. 105*).—A small handbook containing cultural and descriptive data on perennial and annual climbing plants.

FORESTRY

The management of forest properties in the California pine region as a problem in applied ecology, S. B. SHOW (*Sci. Mo., 19 (1924), No. 5, pp. 548-551, figs. 2*).—A contribution from the U. S. D. A. Forest Service, emphasizing the important rôle of fire in influencing succession in California coniferous forests. That yellow and sugar pines, because of their greater resistance to fire, occupy a greater proportion of the mature forest than would be the case in the absence of fire was indicated in records taken in Lassen County, where 80 per cent of the mature forest was classified as yellow pine type, as compared with 51 per cent in the advance reproduction constituting the basis for the new stand. In the absence of fire, firs and cedars tend, because of their greater tolerance, to become the climax forest, and since pine lumber is more highly prized than fir, silvicultural practices such as heavy cutting, which tend to encourage reproduction of the pine, are recommended as desirable.

Forestry in the Malay Peninsula, G. E. S. CUBITT (*Kuala Lumpur: Govt., 1924, pp. 24, pl. 1*).—This is a statement prepared for the British Empire Forestry Conference, held at Ottawa, Canada, in the summer of 1923.

Discontinuous growth rings in California redwood, E. FRITZ and J. L. AVERILL (*Jour. Forestry, 22 (1924), No. 6, pp. 31-38, figs. 2*).—As a result of microscopic studies of sections of the trunk of second-growth redwoods exhibiting a lack of symmetry in growth ring development, sometimes being perfectly normal on one side and entirely lacking on the opposite, the authors conclude that this phenomenon is due to injuries, possibly from rodents, received while the trees were young. Since discontinuous rings introduce an important source of error in age studies carried on with the increment borer, the authors suggest that with such trees care be taken to insert the borer from that side of the tree bearing most of the branches. When an injured tree receives more light, permitting the development of new branches on the wounded side, normal ring development is resumed.

Acceleration of growth in western yellow pine stands after cutting, H. KRAUCH (*Jour. Forestry, 22 (1924), No. 6, pp. 39-42*).—Data taken on 106 isolated or partly isolated western yellow pine seed trees, ranging from 15 to 26 in. in diameter and approximately 200 years in age, showed that these trees

had made a remarkable increase in diameter growth in the 25 years which had elapsed since the area was logged. The average increase for 45 trees ranging between 15 and 20 in. in diameter was 4.43 in., and for 61 trees between 21 and 26 in., 5.75 in. On the other hand, the growth during a corresponding period previous to logging was only 0.97 and 1.37 in. for the two groups, respectively. The author believes that in short cutting cycles of 50 years or so these seed trees might survive and be profitably utilized as lumber.

Quality and growth of white pine as influenced by density, site, and associated species. E. E. TARBOX (*Harvard Forest Bul.* 7 (1924), pp. 30, pls. 8).—Growth studies, carried on by the author with field assistance by P. M. Reed on 72 sample plats of pure white pine located on different quality sites in central Massachusetts and southern New Hampshire, indicated that within very wide limits the density of stand has no apparent direct influence upon current height growth. It was noted, however, that density had an indirect influence, since weevil injury was much less severe in the thicker stands.

It was found that knot size is largely determined by the length of time required for the tree crowns to meet and form a canopy. Hence fully stocked, uniform stands insure the highest quality lumber. A constant relation was found between the average knot size in the first 12-ft. log and the number of trees per acre for all pure white pine stands whose crowns had closed by the twentieth year.

In stands allowed to remain densely stocked after 30 years of age crown friction reduced yields, leading to the general recommendation that improvement cuttings will not only yield quick financial returns but also show a benefit in increment of the remaining trees. Yield tables compiled for 72 plats showed that, unless thinned, growth on the first-quality sites at 65 years is surpassed by that on second-quality sites, a situation explained by the greater amount of crown friction on the better-quality sites.

Studies of mixed pine and hemlock showed the two species to form an ideal combination, resulting in higher grade lumber than that obtained from either pure pine or the pine hardwood stands. At about 50 years the pines outstripped the hemlocks, which thenceforward constituted a lower story sufficiently dense to suppress branching and at the same time separated the pines so as to minimize crown friction injury. The quality of white pine as expressed by average knot size was superior in well-stocked mixed pine and hardwood stands than in pure pine stands.

Rattan (*Singapore: Malayan Govt., 1924, pp. 22*).—This brief pamphlet relating to the present status of the rattan industry in Malay constitutes No. 17 of the Malayan Series prepared for the British Empire Exhibition held in London in 1924.

Gutta percha (*Singapore: Malayan Govt., 1924, pp. 22*).—This is No. 18 of the series noted above. Although more than 100 species of the family Sapotaceae in British Malay produce a latex containing gutta percha, in only a few species of the genera *Palaquim* and *Payena* is the substance present in sufficient quantity to be of commercial importance. The most important species, *Palaquim gutta*, usually occurs as a second story in mixed forests, which experiments have shown can be greatly improved by selective cuttings which allow more light to reach the gutta percha trees.

That the gutta percha tree is capable of making rapid growth was shown in measurements of 282 trees, the records showing an average girth increment of 1.57 in. per annum. Regeneration naturally occurs by seed, the limited supply of which is a severe handicap to commercial propagation. Methods of harvesting which include tapping and harvesting of leaves are briefly discussed, and descriptive notes are included on various species.

Damar and copal (*Singapore: Malayan Govt., 1924, pp. 11*).—This publication, which is No. 19 of the Malayan Series noted above, contains brief notes on several forms of resin known in Malay under the collective name of damar and in European markets as damar and copal, the latter name distinguishing certain harder forms which are relatively resistant to various solvents.

DISEASES OF PLANTS

Studies in bacteriosis.—IX, X, S. G. PAINE and M. S. LACEY (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 194–209, pls. 3).—Two studies are reported.

IX. *Streak disease of broad beans* (pp. 194–203).—“The ‘streak’ disease of beans (chocolate spot disease) [*E. S. R.*, 48, p. 743] is caused by *Bacillus lathyri*. Moist and warm conditions are responsible for the appearance of the disease in epidemic form. The disease is spread by wind, black fly, and the bean beetle. Methods of control are suggested.”

X. *The use of serum-agglutination in the diagnosis of plant parasites* (pp. 204–209).—During investigations of the tomato stripe disease (*E. S. R.*, 44, p. 647) and of the streak disease of beans (see above), several yellow bacteria were frequently isolated. Among these was one which bore a certain superficial likeness to *B. lathyri*, but which differed from it in its physiological behavior, giving in fact all the characters of *Pseudomonas phaseoli*. It seemed possible that the organism might in reality be a degenerate form of *B. lathyri*. Several strains of both organisms were, therefore, cultured simultaneously in bouillon by daily transfers until the tenth day, when they were plated on bouillon agar, and subsequently inoculated into the various sugar and other media generally used for diagnosis. The results showed that even after such treatment the organisms retained their individual characters.

Serum agglutination was then used in order to determine any possible relationship with *B. lathyri* of the yellow organisms. One of these gave all the reactions of *P. phaseoli*. Distinct cultural characters were shown by *P. phaseoli* and *B. lathyri*, these being retained even after the two organisms had been grown in 10 transfers through the same medium. The two organisms seem to be susceptible to group agglutination, *B. lathyri* being agglutinated with the serum of *P. phaseoli*. Intermediate forms are found which agglutinate equally with the sera of both species. The suggestion is made that one species may have arisen in the tissues of the plant as a mutant from the other.

Aplanobacter dissimulans, another organism often associated with *B. lathyri*, appears to bear no sort of relationship with the latter.

A critical study of crown gall, W. ROBINSON and H. WALKDEN (*Ann. Bot. [London]*, 37 (1923), No. 146, pp. 299–324, pls. 2, figs. 4).—The development of the galls produced by the inoculation of cut surfaces of *Chrysanthemum frutescens* with *Bacterium tumefaciens* has been traced from the earliest stages, and it is said that the effect of the bacterial stimulus is to produce a growth very similar in form, structure, and general appearance to callus growths on woody shoots caused by wounding.

Most of the work of E. F. Smith regarding the production of secondary tumors has been repeated, but additional results have been obtained which indicate different interpretations from those adopted by that author. It is held that the results obtained regarding the distribution of the bacteria in the galls invalidate most of the close comparisons which have been made previously between crown gall and malignant tumors.

The killing of *Botrytis cinerea* by heat, with a note on the determination of temperature coefficients, J. H. SMITH (*Ann. Appl. Biol.*, 10 (1923),

No. 3-4, pp. 335-347, figs. 5).—The previous paper (E. S. R., 45, p. 821) showing the action of phenol on spores of *B. cinerea* has been followed by a similar inquiry into the action of moist heat, the method employed being essentially the same as with phenol, dropping the spores into distilled water at chosen temperatures and ascertaining the percentage able to germinate in each case.

Spores of *B. cinerea* were exposed to water at from 31 to 50.3° C., and the results were plotted for each temperature. These experiments give a series of approximately symmetrical sigmoid curves, alike except for the change in the speed of killing at different temperatures. The curves are superimposable on adjustment of the time scale, and in this respect they differ from the curves obtained with phenol, where the shape changes from an S to a J shape as the strength of phenol is increased, eventually becoming logarithmic.

The shape of the general curve agrees excellently with a recognized type of frequency distribution, and the observations at all the temperatures examined fall closely on the curve of this distribution. The effect of temperature on the velocity of the reaction is unusually great, and is well expressed by the formula of Arrhenius if the temperature is reckoned from 0° instead of -273° C.

By combination of the formula for the curve and the formula for the velocity-temperature relationship, it is possible to express completely for the spores of Botrytis the whole of the killing process for any temperature within the limits studied under the conditions and with the strain used in these experiments.

A study of the growth in culture of *Verticillium albo-atrum*, H. CHAUDHURI (Ann Bot. [London], 37 (1923), No. 147, pp. 519-539, figs. 12).—This paper deals with the growth of *V. albo-atrum*, with special reference to the effects of temperature and aeration. A comparison is made also of the method of estimating growth by the surface spread of the fungus on a solid medium with a method of dry weight determination. The latter portion of the paper deals with zone formation, and some of the conditions which bring about such formation.

V. albo-atrum was found to grow on a large variety of media, always rendering such medium alkaline. Asparagine in Coons' medium can be markedly reduced without much affecting the growth of the fungus. On the other hand, reduction in concentration of the maltose in this medium markedly reduces the growth. The growth optimum is 22.5° C., the maximum 30°, and the minimum 10°. Aeration in liquid media markedly increases rate of growth, also total growth. It appears to increase growth by reducing the production of waste products, rather than by removing (oxidizing?) such products.

"The rate of 'spread' as a measure of actual production of fungal material was found to be extremely untrustworthy. It gives, however, a satisfactory measure of the effect of different temperatures on the rate of growth in a medium of constant composition and constant thickness. When, however, different media are concerned, the same rate of surface spread may be associated with extremely different rates of mycelium production. In surface 'spread' the fungus follows approximately the compound interest law, but the dry-weight production there is more nearly a linear relation of time.

"For cultures on solid media in the dark, zonation is confined to a temperature of about 25°; there is no zonation at 24° or 26°. In the light, however, such cultures will show zonation at about 23°. The zones are more closely packed in a culture on a thick layer of medium than in that on a thin layer. There is no evidence that accumulation of waste products in any way favors zone formation."

The more injurious fungi of cultivated plants in and near Turin, 1921 [trans. title], P. VOGLINO (*Ann. R. Accad. Agr. Torino*, 65 (1922), pp. 53-64).—Following an account of conditions favoring cryptogamic injury, about 40 organisms, nearly all fungi, are mentioned in this connection.

Diseases and pests of cultivated plants in Poland in 1921-22 [trans. title], L. GARBOWSKI (*Rocz. Nauk Rolnicz.*, 11 (1924), No. 1, pp. 63-115, figs. 3).—Nearly 70 disease organisms are noted, including bacteria, besides a number of animal pests, including nematodes.

Methods of controlling diseases and pests, I [trans. title], E. VOGT (*Centbl. Bakt. [etc.]*, 2 Abt., 58 (1923), No. 1-3, pp. 66-77).—A general review is given of spraying and dusting as regards their modifications and results for diseases and pests over different areas.

Copper sulfate as fungicide and anticryptogamic [trans. title], E. CRIVELLI (*Ann. R. Accad. Agr. Torino*, 65 (1922), pp. 23-32).—Chiefly, examination is made herein of statements in contributions dealing with questions regarding the indispensability of copper in preparations designed for use to protect economic plants against disease fungi.

On the occurrence of maize rust in the Philippines, G. M. REYES (*Philippine Agr. Rev.*, 17 (1924), No. 1, pp. 3-9, pls. 4).—In June, 1923, a disease of corn was found in material collected at altitudes of from 3,000 to 4,000 ft. The trouble appears to be caused by *Puccinia sorghi*.

Fungicidal powders for wheat smut [trans. title], J. PONSARD (*Jour. Agr. Prat.*, n. ser., 42 (1924), No. 30, pp. 75-77, fig. 1).—Dust seed treatments for cereal smut, apparently as used by Mackie and Briggs (*E. S. R.*, 44, p. 343; 48, p. 545; 50, p. 43), are said to have proved effective in Australia, Canada, Italy, and Denmark.

Effect of moisture on a seed-borne bean disease, L. T. LEONARD (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 5, pp. 489-497, figs. 4).—In a previous publication (*E. S. R.*, 49, p. 751) the author called attention to a wilt disease of navy beans, which seemed to arise from the application of a legume bacteria culture to the seed prior to planting or to be favored by such an application.

In the present communication an account is given of the yields of the crop of 1922 in this region and of experiments on the relation of moisture to disease in 1923. It is believed that there is a general tendency toward reduced crops of navy beans, due to applications of moisture to seed presumably harboring *Bacterium flaccumfaciens*, prior to planting. This is indicated by the harvests from various places where experiments were carried on. To prevent these losses the author recommends the use of dry soil as inoculating material where it is necessary to introduce *Bacillus radicolica*, and the employment of clean seed.

A bacterial disease of foxtail (*Chaetochloa lutescens*), H. R. ROSEN (*Arkansas Sta. Bul.* 193 (1924), pp. 3-52, pls. 7, fig. 1).—This is a reprint of an article previously noted (*E. S. R.*, 50, p. 349).

Studies in the varietal immunity of potatoes to wart disease (*Synchytrium endobioticum* Schilb., Perc.).—I, The influence of the foliage on the tuber as shown by grafting, W. A. ROACH (*Ann. Appl. Biol.*, 10 (1923), No. 1, pp. 142-146).—This investigation is a section of a larger study of the problems of immunity to wart disease (*S. endobioticum*) of potatoes and the control of this disease, in which the departments of mycology and insecticides and fungicides at Rothamsted are collaborating.

Grafting experiments of a preliminary nature have been carried out to throw light on the functions of the various organs of the potato plant in rendering the tubers immune or susceptible to wart disease. Composite plants were built

up by grafting 3 plants of the type immune on immune, 3 plants of the type susceptible on immune, 4 plants of the type immune on susceptible, 2 plants of the type susceptible on susceptible. The results were in harmony with the conclusion that "the character of the foliage has no influence on the immunity or the susceptibility of the tubers to wart disease. It follows that no compound synthesized in the leaves is likely to be responsible for separating potatoes into 'immunes' and 'susceptibles.'

"The investigation is being continued, and it is hoped to determine whether any one part of the plant influences the immunity or susceptibility to the disease of any other part. . . . If the several parts of the plant have no such effect on each other, a search for differences in substances such as the proteins, which are only translocated with difficulty, if at all, would be indicated."

Potato black wart [trans. title], A. VOLKART, E. NEUWEILER, and O. PERRIN (*Ann. Agr. Suisse*, 24 (1923), No. 2, pp. 51-73, figs. 3).—A general account is given of potato black wart, which has not yet reached Switzerland. This disease has established itself with more or less intensity at points in the British Isles, Germany, and the Netherlands, and exists or has existed at points in other European countries.

Data regarding root rot in sugar cane, variety EK 28 [trans. title], J. M. GEERTS (*Arch. Suikerindus. Nederland. Indië*, 31 (1923), No. 29, pp. 711-731).—Data are tabulated with discussion regarding the incidence of sugar cane root rot on varieties, particularly EK 28. This variety, when planted the second year on the same ground, appears to be more susceptible to root rot than when following another variety. It appears also to be more susceptible on mixed soils than on soils of pure type.

Studies on curly-top disease of the sugar beet, E. CARSNER and C. F. STAHL (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 4, pp. 297-320, pls. 5, fig. 1).—The results are given of an investigation of the curly-top disease of sugar beets carried on for the most part in California. The disease is characterized by a dwarfing of the whole plant, curling of the leaves, and irregular swelling of the veins on the under sides of the affected leaves. It is said to occur only in the semiarid regions of the western part of North America, and it is the cause of greater losses than any other disease of the sugar beet.

The causative agent is as yet unknown, but the beet leaf hopper (*Eutettix tenella* Baker) is the only known means of transmission. The leaf hopper is said to be unable to transmit the disease unless it has been feeding on infected plants, and even then it does not always produce the disease.

The influence of various factors on the disease was studied, and it was found that plants kept in darkness during the period of inoculation were more readily infected through their cotyledons than through their leaves. Heat did not destroy the virus except at temperatures that killed the beets, but it is thought that drying may destroy it. The virus was found to be distributed through all parts of the plant. No evidence appeared to indicate that the disease is due to specific bacteria.

A wide range of species of native plants has been found susceptible to curly top, and the virus is believed to overwinter in susceptible wild annuals, in volunteer beets, and in the insect carrier.

No satisfactory control of the leaf hopper by artificial or biological means has been discovered, but it is thought that early planting would avoid much of the injury. There is believed to be a basis for the development of resistant strains of beets.

Fungi associated with "die back" in stone fruit trees, I, D. M. CAYLEY (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 253-275, pls. 4).—*Diaporthe*

perniciosa, first isolated by Marchal from rots in stored fruits, has proved to be parasitic and one of the causes of die-back in stone fruit trees. The various strains isolated from die-back on peach and different varieties of plums have proved to be parasitic and morphologically identical, and to cause definite wilt and die-back on peach, plum, apricot, and nectarine. It has a pycnidial or Phomopsis stage with "a" and "b" spores, and a perithecial or Valsa stage with numerous eight-spored asci. It shows a certain degree of polymorphism on the host plant, this being much more marked on artificial media.

Apricot fungus diseases in Valais [trans. title], H. FAES and M. STAEHELIN (*Ann. Agr. Suisse*, 25 (1924), No. 1, pp. 117-139, figs. 10).—An account of observations, also of pathological studies, on the disease of apricot prevalent in Valais caused by *Stromatinia* (*Sclerotinia*, *Monilia*) *laxa*, including portions of the years 1922 and 1923, shows that parasitic fungus to constitute a grave danger to apricot culture in Valais.

Leather rot of strawberries, D. H. ROSE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 357-376, pls. 2, figs. 6).—The results are given of an investigation of a serious disease of strawberries in the southern Mississippi Valley. It was found that a species of *Phytophthora* was constantly associated with the disease, and evidence is presented which is said to indicate that it is probably identical with *P. cactorum*. A close relationship was found to exist between the occurrence of leather rot and rainfall, and in the region studied the rot can be expected to reach a maximum within three or four days after heavy rains. Temperature is also considered an important factor in the occurrence of the disease.

Signal service regarding attacks of *Plasmopara viticola* in 1921 [trans. title], P. VOGLINO (*Ann. R. Accad. Agr. Torino*, 65 (1922), pp. 3-12).—In a communication from the Phytopathological Observatory at Turin, the author gives a further account (*E. S. R.*, 46, p. 849) of the signal service, which was put into operation about 1917 (*E. S. R.*, 45, p. 444), relating to attacks of *P. viticola* in the Provinces of Turin, Cuneo, and Novara, the plan of organization, and the work.

Collar crack of cocoa, R. H. BUNTING (*Jour. Gold Coast Agr. and Com. Soc.*, 2 (1923), No. 3-4, pp. 164, 165).—The fungus causing locally a fatal disease of cacao has been determined as an *Armillaria* closely affiliated if not identical with *A. mellea*.

In this region the collar crack disease of cacao has, up to the present, been found in five districts, Kpoeta, British Togoland; Akrofofo, Otsineso, and Kibbi in Akim, Eastern Province; and Akrokerri, Ashanti. It is always associated with excessively damp conditions. The fungus is supposedly carried to crops by dead or dying bush-trees. The toadstools apparently grow from the soil near diseased trees, and they are enabled to do this by means of the black vegetative strands running from the host. It is, therefore, important to destroy all traces of affected trees.

"Thread" diseases of cocoa in the Gold Coast, H. A. DADE (*Jour. Gold Coast Agr. and Com. Soc.*, 3 (1923), No. 1, pp. 9-12, pls. 2).—Two types of cacao thread disease known on the Gold Coast as white thread blight and as horse-hair blight, respectively, are discussed descriptively in connection with their effect and with prevention, which consists principally in sanitation. The first is superficial, but presumably parasitic. At least, its presence causes death of the leaves. It has been identified in part with a fungus here designated as *Marasmius scandens*. The second is said to be purely saprophytic, but it accumulates rubbish favoring other fungi as well as pests. It may prove not to be due to *M. equicrinus*.

Bud rot of coconut in Porto Rico [trans. title], C. M. TUCKER (*Rev. Agr. Puerto Rico*, 12 (1924), No. 6, pp. 385-390, figs. 2).—Coconut bud rot is now spreading rapidly in Porto Rico, the disease corresponding symptomatically on this island to that existing in Jamaica, India, and the Philippines, but not to the Cuban type. It is transmitted through the medium of wind, birds, and insects. Close inspection and quick destruction of infected trees are important.

Nut fall of coconuts, C. H. GADD (*Ceylon Dept. Agr. Bul. 53* (1922), pp. 18, pls. 3).—The fall of nuts (buttons) shortly after the opening of the inflorescence is regarded as a natural consequence of the production of an excess of female flowers. This is not normally a diseased condition, though external factors such as drought may adversely affect the fall of such immature nuts. The fall of older but still immature and useless nuts may be due to causes classed as organic, and including the attacks of fungi, particularly *Phytophthora* sp., on the nuts or nut branches, or else as mechanical or physiological, that is, due to environmental conditions, for example, the breaking of the fruiting branch due to the removal of the support given by the subtending leaf.

Spraying with Bordeaux mixture (which is regarded as beneficial ordinarily) yielded in 1921 no results as a preventive of nut fall, due supposedly to the fact that the fungus was not found in either of the experimental plats during the course of the experiments. This probably resulted from the climatic conditions of that year, which were unfavorable to the growth of the fungus.

Liberian coffee disease, R. H. BUNTING (*Jour. Gold Coast Agr. and Com. Soc.*, 2 (1923), No. 3-4, pp. 163, 164).—The fungus causing the mealy pod disease of cacao is said to have been first discovered as the cause of a disease on the fruits of Liberia coffee in this colony. It has not been definitely proved that it attacks other species of coffee.

Until recently the fungus was thought to confine its attacks to cacao, but natural infections of the young fruits of *Coffea liberica* (most of which had previously been attacked by insects) have been found at Aburi. It has also been found recently as a wound parasite on the fruit of the avocado.

A brown bast census, A. T. REEVE (*Ceylon Dept. Agr. Yearbook*, 1924, pp. 14, 15).—A census of trees affected with brown bast on an estate in the Kelani Valley, made in order to ascertain accurately the percentage of trees so diseased, is given as carried out in August, September, and October, 1923, on trees planted in 1903 and 1911.

The wilt disease of safflower, S. D. JOSHI (*India Dept. Agr. Mem., Bot. Ser.*, 13 (1924), No. 2, pp. 39-46, pls. 3).—The safflower (*Carthamus tinctorius*), grown in many parts of India, where it is increasingly important economically, was first observed to be affected by wilt during 1920 at Pusa and later at Sankni in the district of Bulandshahr. It appears to be favored by low temperature and abundant rainfall. At Pusa, some varieties have shown as high as 30 per cent of wilt. The fungus, *Sclerotinia sclerotiorum* (*Rhizoctonia napi*), grows on different media. The sclerotia appear to live, normally, somewhat more than a year. They are killed by immersion in water at 50° C. (122° F.) for five minutes. Practical control measures include collection and destruction of the infective material, deep plowing, and clean weeding.

Soft rot of Vanilla planifolia Andrews, C. RAGUNATHAN (*Ceylon Dept. Agr. Yearbook*, 1924, pp. 52-55).—In May, 1922, a disease attacking vanilla leaves and stems appeared at the experiment station, Peradeniya, the symptoms and accompanying organisms differing somewhat as herein briefly described. Of the fungi separated *Glomerella* sp. I is said to be the perfect stage of the *Volutella* found. *Glomerella* sp. II is described, as is also *Colletotrichum* sp. (*C. vanillae?*).

Pecan scab with special reference to sources of the early spring infections. J. B. DEMAREE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 321-330, pls. 2).—According to the author pecan scab, caused by *Fusicladium effusum*, is one of the most important diseases affecting the pecan. The disease is known to exist in all the Southern States bordering the Atlantic Ocean and Gulf of Mexico, as well as in Arkansas. A wide variation in the degree of susceptibility of the different cultivated varieties is known, some varieties being very susceptible, while others are almost immune. The fungus is said to attack the nuts, twigs, leaves, dormant buds, and catkins, but does little, if any, damage to the buds and catkins. It is said to live through the winter months in lesions upon the surface of twigs, rachises, petioles, and shucks. It is believed the twig lesions can be largely prevented by thorough summer spraying. Of the various spray materials tested, Bordeaux mixture has proved the most effective, although it sometimes causes serious injury to the foliage. Strong Bordeaux mixture and strong lime-sulfur solution used as dormant sprays did not perceptibly reduce the amount of infection.

Spraying experiments for pecan scab control in Mississippi in 1923. D. C. NEAL, O. M. CHANCE, R. P. BARNHART, and E. K. BYNUM (*Mississippi Sta. Circ.* 53 (1924), pp. 4).—A report is given of spraying experiments for the control of pecan scab carried on in 1923 in three separate localities in the State. As a result of these experiments Bordeaux mixture was found to be the most effective fungicide for controlling the scab. The 4-4-50 formula was used with a minimum of foliage injury. Weaker solutions have also been found effective in combating the disease. The critical period for scab control is said to be when the young nuts have formed. Under Mississippi conditions the majority of pecans are pollinated by May 15, and the first Bordeaux spray should be applied as soon thereafter as possible.

Evidence has been obtained which indicates that the pecan scab overwinters to a considerable extent as spots on the twigs, and a dormant spray of 1 to 8 lime-sulfur solution is recommended, the application to be made late in the season or just before growth begins.

Attention is called to the importance of keeping scab under control by the destruction of old infected leaves, twigs, husks, and other debris under bearing trees.

A disease of poplar [trans. title], E. FOËX (*Rev. Hort.* [Paris], 95 (1923), No. 21, pp. 476, 477).—Poplar trees in the Garonne Valley are attacked by a distinctive disease where injuries afford entrance to the causal fungus, *Cenangium populneum*.

The origin of "golden" oak. H. S. WILLIAMSON (*Ann. Bot.* [London], 37 (1923), No. 147, pp. 433-444, pl. 1, figs. 4).—A specimen of seasoned heartwood of *Quercus robur* on examination showed yellow coloration externally, extending inwardly for 2 or 3 mm. *Eidamia catenulata* was isolated both externally and internally, and is considered the cause of the golden color. This fungus in the infected tissue gives rise to a yellow substance which somewhat resembles in its reactions the material termed wood-gum. The hyphae advance in the heartwood along the medullary rays in a transversely radial direction and in the wood parenchyma, fibers, and vessels longitudinally in the main. Passage from cell to cell takes place only through pits in the walls, and there appears to be no delignification or attack on the walls themselves. The source of food for the fungus in the heartwood of oak is probably soluble, pectic bodies, glucosides, gallic acid, starch, proteids, or organic salts that may occur.

Dissemination of the stem and bulb infesting nematode, *Tylenchus dipsaci*, in the seeds of certain composites. G. H. GODFREY (*Jour. Agr. Re-*

search [U. S.], 28 (1924), No. 5, pp. 473-478, pls. 3).—In a previous publication (E. S. R., 51, p. 53) the author reported the leaf and stem infesting nematode abundant on the false dandelion (*Hypochaeris radicata*) from Tacoma, Wash., to San Francisco, Calif. In the present publication he reports its occurrence in the true dandelion (*Taraxacum officinale*) in western New York, Ontario, Can., and at Boston, Mass. In these plants the nematode produces swellings and distortions of the leaves, and they also penetrate the developing flower head, producing more or less distortion. In the case of the false and true dandelion, nematodes were observed to have penetrated into the interior of the seed, and this is believed to account for the wide distribution of nematodes on these host plants.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Breeding, feeding, and other life habits of meadow mice (*Microtus*), V. BAILEY (*Jour. Agr. Research* [U. S.], 27 (1924), No. 8, pp. 523-536, pls. 3).—Following an introduction, the author deals at length with the subject under the headings of mouse plagues; study of habits; general habits of *M. pennsylvanicus*, including voices, dispositions, individuality, playing, fighting, and sanitation; breeding habits, including frequency, mating, nests, care of young, and factors modifying breeding; food habits, including stores, in captivity, quantity of food required, and aggregate destructiveness; methods of control; and uses. A list of 21 references to the literature is included.

In a study of the life history of the common eastern representative of the group, *M. pennsylvanicus*, which, with its subspecies, covers over half of the continent of North America, the author finds that in captivity the young, if well fed, begin to breed when less than half grown, the females mating with older males when only 25 days old and having young when 45 days old, and the young males mating when only 45 days old. "The period of gestation is approximately 21 days, in one case 20 days and 17 hours. The breeding activities are practically continuous, the females mating immediately after the birth of the young and producing litters of usually 4 at first, but when full grown, after the first or second litter, usually 6 or 8 at a birth. Seventeen consecutive litters of young have been produced by one female in captivity within a year." The number of young in a litter ranges from 2 to 9, and with the original pair averaged 5, totaling 83 in 17 litters.

In their native habitat *Microtus* feed to a great extent on grasses and sedges, but also on the clovers and a great variety of meadow and upland plants, eating the green tops, flowers, seeds, and roots. In a record kept of one cage of 10 mice for 30 days, during which time they were fed with clover, cantaloupe, grain, and seeds, it was found that they consumed an average of 55 per cent of their weight every 24 hours.

Revision of the American pikas (genus *Ochotona*), A. H. HOWELL (*U. S. Dept. Agr., Bur. Biol. Survey, North Amer. Fauna* No. 47 (1924), pp. IV+57, pls. 6, figs. 4).—This is a synopsis of the genus *Ochotona*, the pikas or "rock conies," which inhabit rocky country, mainly in mountainous regions, and in America are found in such situations in the western part, ranging from Alaska to California and New Mexico. Twenty-six forms, representing three species, are recognized as occurring in America.

Birds of the New York City region, L. GRISCOM (*New York: Amer. Mus. Nat. Hist.*, 1923, pp. 400, pls. 7, figs. 30).—In an introductory account the author considers life zones, seasonal variation in bird life, migrations and movements of local birds, local regions, the local collection, and changes in bird life, and includes a bibliography of useful literature. The annotated list of local birds takes up the larger part of the work (pp. 56-377), followed

by appendixes dealing with extinct and extirpated species, introduced species, and a hypothetical list.

A guide for visits to the collection of arachnids, myriapods, and insects, with special consideration to arthropod enemies of man and agriculture, M. HERRERA (*Guía para Visitar la Coleccion de los Aracnidos, Miriapodos e Insectos con Especial Indicacion de los Artropodos Nocivos al Hombre y a la Agricultura. Mexico: Sec. Agr. y Fomento, Dir. Estud. Biol., 1923, pp. 200, pls. 59, figs. 126*).—This introduction and guide includes a catalogue list of Mexican insects in the National Museum of Natural History.

The fauna of France, illustrated, III, R. PERRIER (*La Faune de la France, Illustrée, III. Paris: Libr. Delagrave, 1923, pp. XI+154, figs. 495*).—This third part of The Fauna of France deals with myriapods and the lower insects.

Report of the proceedings of the fifth entomological meeting, held at Pusa February 5 to 10, 1923, edited by T. B. FLETCHER (*Ent. Meeting Pusa, Rpt. Proc., 5 (1923), pp. XIII+422, pls. 38*).—The papers presented at this entomological meeting (E. S. R., 47, p. 357) are as follows: Notes on Pests Investigated in Madras during the Years 1921–22, by Y. Ramachandra Rao (pp. 19–22); Fruit Sucking Moths of South India (pp. 23–27) and Some Important Pests of the Malay Peninsula (pp. 28–33), both by P. Susainathan; Some Parasites of the Cotton Bollworms (*Earias insulana* and *Earias fabia*) in the Punjab, by M. Afzal Husain and U. Bahadur Mathur (pp. 34–52); Colour Variations in *Earias insulana* Boisd., in the Punjab, by U. Bahadur Mathur (pp. 53–55); A Note on a New Cotton Bollworm, *Rabila frontalis*, by Y. Ramachandra Rao (pp. 56, 57); The American Cotton Boll Weevil: A Menace to India, by T. B. Fletcher (pp. 58–64); Preliminary Observations on the Attraction to Light of Moths of Sugarcane Borers, by D. Nath (pp. 65–74); A New Remedy for Sugarcane Borers: A Preliminary Note, by K. Kunhi Kannan (pp. 75, 76); A Preliminary Note on the Borers of Sugarcane, Rice, etc., in Burma (pp. 77–86), A Note on the Rice Hispa, *Hispa armigera* (pp. 87, 88), A Note on *Nymphula depunctalis*, Rice Case Worm (p. 89), and A Note on the Occurrence of *Cirphis unipuncta* in the Rôle of "Army Worm," all by C. C. Ghosh (pp. 90, 91); An Outbreak of *Nephantis serinopa* at Mangalore in 1922, by Y. Ramachandra Rao (pp. 92–98); *Oryctes rhinoceros* and Other Important Palm Pests in Burma, by C. C. Ghosh (pp. 99–103); An Interesting Principle in Economic Entomology and Some Suggested Applications, by K. Kunhi Kannan (p. 104); A Note on *Anomala antiqua*, by C. C. Ghosh (pp. 105–107); Some Coccinellids of South India, by T. V. Subramaniam (pp. 108–118); A Preliminary List of Parasites of Economic Importance Bred in the Punjab, by M. Afzal Husain and U. Bahadur Mathur (pp. 119–121); The Life-History of *Tetrastichus radiatus*, Parasitic on *Euphalerus citri* Kuw, and Its Hyperparasite, by M. Afzal Husain and L. D. Nath (pp. 122–128); The Citrus White-Fly, *Dialeurodes citri*, in India and Its Parasites, together with the Life-History of *Aleyrodes ricini* n. sp., by C. S. Misra (pp. 129–135); A Note on *Paratelpusa hydrodromus* Herbst, the Fresh-Water Crab of South India, by Y. Ramachandra Rao and P. Susainathan (pp. 136–140); Crabs Damaging Paddy in Burma (pp. 141–146) and A Note on Rat Pests in Burma (pp. 147–150), both by C. C. Ghosh; Rat Destruction on a Field Scale: Baiting and Fumigation, by M. Afzal Husain and K. Dass Banerjee (pp. 151–158); The Geographical Distribution of the Coleopterous Borers of Sal (*Shorea robusta*) (pp. 159–175) and Recent Work in Forest Entomology (abstract) (pp. 176–179), both by C. F. C. Beeson; The Bionomics of the Sarcoptic Mange Parasite of the Buffalo, with Some Observations Concerning the Relative Power of Resistance to Adverse Conditions of the Different Stages of the *Acarus* and of Its Egg, by T. M. Timoney (pp. 180–200); Occurrence of a Coprid Beetle,

Caccobius mutans Sharp, in the Human Intestines (pp. 201, 202) and The Importance of Animal Prophylaxis in Malaria (pp. 203-214), both by M. O. T. Iyengar; Observations on the Bionomics of *Aedes (Stegomyia) albopicta* Skuse, by S. K. Sen (pp. 215-225); Carbon Bisulphide Not Efficacious as a Mosquito Larvacide, by T. B. Fletcher (pp. 226, 227); Airtight Storage of Grain, by H. Dass Bhasine (pp. 228-237); A Preliminary Account of the Tachardiphagous Noctuid Moth *Eublemma amabilis*, by C. S. Misra (pp. 238-247); A Note on Sericulture in Burma, by C. C. Ghosh (pp. 248-251); Short Note on the Life-History of the Mango-Hoppers (*Idiocerus* spp.) in the Punjab, by M. Afzal Husain and H. Singh Pruthi (pp. 252-260); Life-History Notes on *Vespa cincta* (pp. 261, 262) and Short Notes on Some South Indian Insects (pp. 263-269), both T. V. Ramakrishna Ayyar; A further Contribution to a Knowledge of South Indian Grass Gall Midges, by Y. Ramachandra Rao (pp. 270-274); A Preliminary Note on the Life-History of Certain Anthomyiad Flies, *Atherigona* spp. and *Acritochaeta excisa* Thomson, by E. Ballard and Y. Ramachandra Rao (pp. 275-277); On the Bionomics and Taxonomy of Mutillidae with Special Reference to South Indian Forms, by T. V. Ramakrishna Ayyar (pp. 278, 279); Life-History of *Danaïis limniace* Cram. and Its Parasites, by B. B. Bose (pp. 280-288); The Evolution of the Faculty of Communication in Ants, by R. W. G. Hingston (pp. 289-295); The Life-History of a Tingid Bug, *Monanthia globulifera*, by M. O. T. Iyengar (pp. 296-299); Observations on Some Rhynchota from Northern India, by C. S. Misra (pp. 300-317); The Collection and Study of Indian Orthoptera, by B. P. Uvarov (pp. 318-324); Recent Progress in Our Knowledge of Indian Diptera, by R. Senior White (pp. 325-329); The Genitalia of Certain Anthomyiad Flies (*Atherigona* spp.), by Y. Ramachandra Rao (pp. 330-335); On the Need of a More Careful Study of the Genus *Monophlebus* in India, by E. E. Green (pp. 336-338); A Further Contribution to Our Knowledge of South Indian Coccidae, by T. V. Ramakrishna Ayyar (pp. 339-344); A List of Coccidae in the Pusa Collection, by C. S. Misra (pp. 345-351); A Catalogue of the Braconid Wasps Described from the Indian Region, by T. V. Ramakrishna Ayyar (pp. 352-362); A Note on Colour Variations in a Common Lady-Bird Beetle, *Chilomenes sexmaculata* Fb., by T. V. Subramanyam (pp. 363, 364); The Odonate Fauna of the Palni and Nilgiri Hills, by F. C. Frazer (pp. 365-368); External Genitalia of Lahore Drangonflies, by H. Lall (pp. 369-377); Methods to be Adopted to Make the Indian Farmers Believe in the Instructions for Killing Insect-Pests, by H. Singh (pp. 378-381); Co-operation in Indian Entomology (pp. 382-387) and Publicity for Entomology in India (pp. 388-390), both by T. B. Fletcher; Some Suggestions for Future Work in Economic Entomology in India, by T. V. Ramakrishna Ayyar (pp. 391-402); A Few Insects Used as Food in Burma, by C. C. Ghosh (pp. 403-405); and A Note on Dimorphism in *Pundaluoya simplicia* Distant (*Dicranotropis maidis* Ashm.), by Y. Ramachandra Rao (pp. 406, 407).

The pyrethrum insecticide from Dalmatia: Origin, culture, active principles, and application in agriculture [trans. title], A. JUILLET (*Min. Com. et Indus., Off. Natl. Matières Veg. [France], Not. 16 (1924), pp. IX+236, pls. 8, figs. 60*).—The several chapters of this extensive account deal with the botanical history of *Pyrethrum cinerarinifolium*, pyrethrum from Persia and from the Caucasus (*P. roseum* and *P. carneum*), the classes of pyrethrum, industrial history of pyrethrum insecticides, culture and commerce of pyrethrum, experimental culture in France, Algeria, and Morocco, methods of culture, harvest and preparation of the blossoms, anatomy and histology of the plant, commercial pyrethrum, toxicity of pyrethrum powder, methods of analysis of pyrethrum insecticide, research on the active principles, application in agri-

culture, pyrethrum soap, the use of pyrethrum soap, etc. A bibliography of 14 pages is included.

Calcium cyanide the new poison, C. W. WINCHELL (*Rural New Yorker*, 83 (1924), No. 4805, p. 1023).—A discussion of calcium cyanide, its several forms, and use as an insecticide.

Injurious insect pests of strawberries, O. C. MCBRIDE (*Missouri Sta. Bul.* 215 (1924), pp. 12, figs. 6).—This is a practical summary of information on the more important insect enemies of strawberries, including a spray schedule.

Notes on *Periplaneta americana* L. and *Blatta orientalis* L. (Orthop.) [trans. title], E. W. ADAIR (*Bul. Soc. Roy. Ent. Égypte*, 16 (1923), pp. 18–38, figs. 5).—This is a report of biological observations of these roaches, in connection with a bibliography of 22 titles.

Morphological studies on the injury to apple caused by *Ceresa bubalis*, J. C. GOODWIN and F. A. FENTON (*Phytopathology*, 14 (1924), No. 7, pp. 334, 335, figs. 4).—The author presents notes based largely on a study of malformations produced in the apple as a result of egg deposition by the Buffalo treehopper.

Reproduction in the Aphididae with a consideration of the modifying influence of environmental factors, L. B. UICHANCO (*Psyche*, 28 (1921), No. 4, pp. 95–109).—In this discussion the author points out that the sexual type of reproduction is the only one known to occur in the Aphididae, and that this process, in this family, takes three forms, namely, amphigony, parthenogenesis, and paedogenesis.

“Amphigony is considered as the more primitive method in insects. Parthenogenesis has practically supplanted it in aphid reproduction. Parthenogenesis in aphids is apparently continuous and uninterrupted under favorable environmental conditions, amphigony occurring only under the influence of low temperatures and, as certain authors claim, inadequate food supply. Aphids in tropical and other warm climates appear to have the tendency to reproduce exclusively by parthenogenesis. The same condition apparently obtains among greenhouse aphids in temperate climates. Aphids in colder climates undergo heterogony as an adaptation to adverse environmental conditions. In certain species, the appearance of the amphigonous generation seems to be a rhythmic process, which continues to occur at definite cyclical intervals for some time after the influence of low temperature has been eliminated. Nothing very definite is known about the relation of food and heterogony. If the quantity of food has any influence at all on the determination of amphigony in a parthenogenetic mother, the effect does not become manifest in the immediate offspring.”

A list of 29 references to the literature is included.

The biology of *Trichopoda pennipes* Fab. (Diptera, Tachinidae), a parasite of the common squash bug, H. N. WORTHLEY (*Psyche*, 31 (1924), Nos. 1, pp. 7–16, fig. 1; 2, pp. 57–77, pls. 4).—The first part of this account deals with the life history and bionomics of the tachinid parasite *T. pennipes*, and the second part with its morphology. This dipteran is widely distributed in the lowlands of North and South America and the adjacent islands, and has been recorded as attacking several species of insects belonging to the hemipterous families Coreidae and Pentatomidae. The common squash bug is said to be the principal host and possibly the only one attacked by the fly in Massachusetts.

The species appears to pass through two full generations annually, the eggs of the first generation being deposited on egg-laying adult squash bugs during July, while those of the second generation attack the older nymphs and new adult bugs in August and September. Collections of squash bugs indicate

a parasitism of 80 per cent. Squash bugs which are parasitized in the fall apparently do not live to sexual maturity, and thus an important natural check is placed upon the increase of this pest. A bibliography of 43 titles is included.

The occurrence of *Muscina pascuorum* Meigen in North America in 1922. C. W. JOHNSON (*Psyche*, 30 (1923), No. 1, pp. 1-5).—The author records the sudden increase and spread of this European fly in the United States in 1922.

Notes on *Muscina pascuorum* Meigen during 1923. C. W. JOHNSON (*Psyche*, 31 (1924), No. 1, pp. 17, 18).—In continuation of the above, the scarcity of the fly during 1923, as compared with its abundance during 1922, is said to be undoubtedly due to the very dry weather during the late summer and fall, there being comparatively little *Amanita citrina*, the fungus in which it is said to develop.

The cambium curculio, *Conotrachelus anaglypticus* Say. F. E. BROOKS and R. T. COTTON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 377-386, pls. 3, fig. 1).—This is an account of a species which occurs rather commonly from Massachusetts to Florida, and its range extends as far west as Iowa, Kansas, and Texas.

The species feeds in a great variety of situations. The beetles frequently occur on peach trees in company with those of the plum curculio, and the larvae have been found attacking peaches, cotton bolls, and the cambium and inner bark of many kinds of fruit, shade, and forest trees. In attacking the cambium of trees they work around the edges of wounds, retarding the healing process and enlarging the injured areas.

"The delicate white eggs are mostly laid at night in situations where the larvae are to feed. Eggs hatch in from two to four days, and a single beetle lays on an average from 25 to 30 eggs. The larvae usually feed from two to four weeks and then enter the ground to pupate. In late summer and autumn the beetles issue from the soil and soon thereafter hibernate, probably in litter on the ground. In Georgia there are two generations of beetles each year, but from West Virginia northward there is but one generation annually."

The larva is attacked in West Virginia by the hymenopteran *Thersilochus conotrachelii* Ril., and in Louisiana the dipteran *Myiophasia globosa* Tns. was reared from infested cotton bolls. Where it attacks peaches, the pest will probably yield to jarring, spraying, and other methods used against the plum curculio. As a precaution against injury to the cambium of valuable trees, the edges of any wounds in the bark should be promptly pared smooth and the injured areas treated to a coat of white-lead paint or some reliable tree paint.

Detailed descriptions of the larva and pupa are by Cotton.

Fumigation of bean weevils, *Bruchus obtectus* Say and *B. quadrimaculatus* Fab., A. O. LARSON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 347-356).—This is a report of observations on the methods of fumigation and their effectiveness when applied to the bean weevil and the four-spotted bean weevil during the course of investigations in the last four years in California. Details of the work are presented, largely in tabular form.

The variation in fumigation results that have been obtained from the use of carbon disulfide against bean weevils is due principally to three factors, namely, (1) the use of a room or fumigatorium which is far from being gas tight, (2) the use of an inferior grade of carbon disulfide, and (3) carrying on the work at too low temperatures, and in some instances, a fourth, namely, too short an exposure. The author finds that, when a good grade of carbon disulfide or hydrocyanic acid gas is used in a gas-tight fumigator

at a sufficiently high temperature and with a sufficiently long exposure, it is entirely possible with one fumigation to kill all the weevils in all stages either among or within beans or cowpeas.

"Small quantities of beans may be thoroughly fumigated with a minimum of 3 lbs. of carbon disulfide per 1,000 cu. ft. at a temperature of 58° F. or higher for a period of 24 hours or with 1.5 lbs. for 48 hours; with 2 lbs. of liquefied hydrocyanic acid for 48 hours at 70° or higher or with 1.3 lbs. for 90 hours; with hydrocyanic acid gas generated from 3.4 lbs. of sodium cyanide by the pot method at 70° for 48 hours or from 1.8 lbs. of sodium cyanide for 90 hours. Large quantities of beans require a longer exposure or a greater quantity of the fumigant, the latter being preferable. When beans are fumigated with hydrocyanic acid gas they should be given an exposure of at least 48 hours."

B. obtectus is most easily killed by either fumigant in the young larval stage just after hatching and just before entering into the bean. Emerged adults, eggs, and young larvae just after having entered the bean succumb to fumigation in the order named, while unemerged adults and pupae are hardest to kill. The depth to which the weevil is buried in the bean is said to be important as affecting its ability to withstand fumigation. Stages of *B. quadrimaculatus* are most easily killed in the following order: Emerged adults, eggs, larvae that have not entirely left the chorion, and young larvae just inside the seed. The other stages appear to be affected almost equally.

Studies on nonarsenical stomach-poison insecticides, W. MOORE and F. L. CAMPBELL (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 395-402).—In attempts made by the U. S. D. A. Bureau of Entomology to discover a satisfactory insecticide for the Japanese beetle, a rather hasty survey of possible arsenical substitutes was made, and many compounds too expensive for practical use were tested with the idea of helping to develop useful laws of insect toxicology. The procedure followed is described, and the results, the details of which are presented in tabular form, are discussed.

"No inorganic nonarsenical was found of noteworthy toxicity to the Japanese beetle. The relative stability of simple metallic cyanides was determined in efforts to explain the differences in toxicity among them. When spread out, as in a spray deposit, copper and nickel cyanides are stable, zinc cyanide breaks down slowly, and so-called lead cyanide hydrolyzes quickly. Copper cyanide was the only nonarsenical tested the toxicity of which was comparable to that of lead arsenate on the Japanese beetle. Copper thiocyanate showed high toxicity to tent caterpillars, but was nontoxic to the Japanese beetle. Complex cyanides and other rather complex insoluble organic compounds exhibited low toxicity, and were interesting only from a theoretical point of view. No definite relations were found between chemical constitution and toxicity."

Systematic and biological notes on bumblebees (Bremidae; Hymenoptera), T. H. FRISON (*Amer. Ent. Soc. Trans.*, 48 (1922), No. 4, pp. 307-326).—These notes, which supplement previous accounts of the bumblebees by the author (*E. S. R.*, 46, p. 463), include descriptions of several new forms.

FOODS—HUMAN NUTRITION

The chemical composition of edible viscera from meat-producing animals, W. C. POWICK and R. HOAGLAND (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, 339-346).—Analyses of edible viscera, which are summarized in the accompanying tables, are reported from the Bureau of Animal Industry, U. S. D. A. The material was all obtained at local abattoirs and the analytical work done immediately after slaughter in the case of constituents subject to

change through enzyme or bacterial action, and in general within 24 hours after slaughter. The analytical methods employed are outlined, with references to the original literature.

The composition of livers is shown in the following table:

Composition of livers expressed in terms of percentages of fresh material

Material	Number of samples	Moisture	Ether extract	Total nitrogen	Purine nitrogen	Total creatinine nitrogen	Glycogen	Dextrose	Total carbohydrate as dextrose
		<i>Pr. ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Ox liver.....	9	70.05	2.98	3.26	0.123	¹ 0.014	1.05	2.22	3.53
Calf liver.....	6	69.83	5.41	3.15	.142	² .015	.49	1.04	1.57
Hog liver.....	6	72.84	5.28	3.17	.164	-----	.00	.25	.25

Material	Number of samples	Total phosphorus	Inorganic phosphorus	Organic phosphorus	Copper	Iron	Calcium	Magnesium	Potassium	Sodium
		<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Ox liver.....	9	0.358	0.099	0.259	0.0039	³ 0.0056	0.0050	0.019	0.281	0.086
Calf liver.....	6	.361	.099	.262	.0045	-----	.0059	.020	.311	.082
Hog liver.....	6	.369	.097	.279	.0004	-----	.0081	.021	.296	.090

¹ Average of 4 analyses.

² Average of 3 analyses.

³ Average of 2 analyses.

The composition of edible viscera other than livers is shown below:

Composition of various edible viscera other than liver expressed in percentages of fresh material

Material	Number of samples	Number of organs making up composite sample	Moisture	Ether extract	Total nitrogen	Purine nitrogen	Total phosphorus	Inorganic phosphorus	Organic phosphorus	Ash
			<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Per ct.</i>
Ox heart.....	6	-----	71.72	9.77	2.77	0.085	0.201	0.061	0.140	-----
Hog heart.....	1 (composite)	10.....	79.29	1.63	2.83	.082	.209	.075	.134	-----
Lamb heart.....	do	10.....	-----	-----	2.20	.086	.171	.044	.127	-----
Ox brains.....	2 (composite)	10 and 22.....	77.65	7.03	1.71	.052	.345	.059	.286	1.53
Hog brains.....	do	50 and 50.....	78.36	7.48	1.65	.038	.342	.076	.266	1.45
Sheep brains.....	1 (composite)	70.....	78.26	7.48	1.71	.046	.333	.071	.262	1.38
Beef kidneys.....	do	10.....	80.12	2.07	2.52	.083	.230	.090	.140	1.11
Hog kidneys.....	do	60.....	76.25	5.41	2.72	.095	.264	.103	.161	1.18
Ox tongue.....	2	-----	-----	-----	2.89	.077	.164	.091	.073	.92
Hog tongue.....	1	14.....	68.30	13.27	2.72	.081	.186	.095	.091	.94
Lamb tongue.....	1	46.....	69.51	15.32	2.23	.058	.147	.078	.069	.80
Calf pancreas.....	1	35.....	70.44	11.10	2.63	.205	.326	.063	.263	1.25
Hog pancreas.....	1	Unknown.....	64.12	18.40	2.54	.126	.331	.067	.264	1.19
Ox spleens.....	1	5.....	77.48	2.26	2.94	.180	.284	.059	.225	1.41
Hog spleens.....	1	50.....	79.00	1.88	2.76	.167	.298	.078	.220	1.44
Ox lungs.....	2	-----	78.17	2.07	2.89	.109	.215	.046	.169	1.09
Lamb lungs.....	1	5 pairs.....	78.00	2.36	2.90	.133	.180	.075	.105	1.30
Ox stomach, cooked.....	1	-----	81.08	2.39	2.65	.023	.040	.003	.037	.22
Hog stomach, cooked.....	1	-----	73.96	8.95	2.64	.074	.118	.020	.098	.57

In commenting on these data, the authors state "in so far as the data bear upon the question of nutritive value, they show that the edible viscera are preeminently nitrogenous foods, and as such are most properly compared with meat as a standard. A practical equivalence between lean beef muscle and the livers of ox, calf, and hog, in this respect, is indicated, while the other organs

examined were all inferior to beef muscle in their nitrogen content. With the exception of hearts, tongues, lungs, and stomachs, on the other hand, the edible viscera examined were found to be richer in phosphorus than is beef muscle."

On the specific dynamic action of proteins in thin and fat individuals (dogs), R. GIBBONS (*Amer. Jour. Physiol.*, 70 (1924), No. 1, pp. 26-28, figs. 2).—Graphs representing the averages of 27 and 25 experiments, respectively, are given, showing the specific dynamic action of 200 gm. of lean meat (heart muscle) in a lean dog and a fat dog of the same weight. The specific dynamic action of the protein was consistently higher for the lean than for the fat dog. This is suggested as a possible factor in hereditary tendency toward adiposity or leanness.

Day to day variations in basal metabolism of women, R. HAFKESBING and M. E. COLLETT (*Amer. Jour. Physiol.*, 70 (1924), No. 1, pp. 73-85, figs. 3).—Basal metabolism experiments were conducted almost daily for about four months on two women subjects with results which are summarized as follows:

"The average basal metabolism is 5 to 8 per cent below the Harris-Benedict standard. Basal metabolism is about 5 per cent higher in cold weather (3 to 10° C.) than in hot (20 to 27° C.) Average variation is ± 4.4 per cent for one subject, +5 per cent and -6.3 per cent for the other. The maximum variations are, respectively, +12.8 and -9.5 and +8.8 and -14.4 per cent.

"Basal metabolism of both subjects is low on the first or second day of menstruation and often throughout the period. There is frequently a premenstrual rise and intermenstrual minimum. The difference between high and low levels amounts to 5 per cent. Pulse rate is steady and shows no correlation with either temperature or menstruation."

Among the factors considered to cause variation in basal metabolism are any conditions interfering with the relaxation of the subject, such as harsh or sudden noises, anxiety, excitement, and overfatigue. Slight digestive disturbances and infections were found to cause increased metabolism at first, followed by a drop below normal.

The importance of mineral elements in the nutrition of children, J. B. ORR (*Jour. State Med.*, 32 (1924), No. 9, pp. 421-430).—A general discussion based upon recent authoritative literature, 22 references to which are appended.

Nutrition studies in a Berlin orphan asylum, with particular reference to calcium metabolism [trans. title], E. ROST, O. HERBST, and A. WEITZEL (*Arb. Reichsgesundheitsamt. [Germany]*, 53 (1923), No. 3, pp. 543-561).—The purpose of the metabolism studies reported was to determine whether calcium retention in boys about 13 years of age could be increased by the addition of a calcium salt to a diet already fairly rich in calcium. The experiment covered a 6-day foreperiod, 6 weeks on the original diet supplemented with the calcium salt, and an afterperiod of 6 days without the salt. Four boys in a Berlin orphan asylum were used as subjects. Their diet furnished 63 gm. of protein, 44 gm. of fat, and about 2,258 calories, representing 1.99 gm. protein, 1.3 gm. fat, and 68 calories per kilogram of body weight. The calcium content of the diet was equivalent to 1.52 gm. of CaO daily. This was supplemented during the main period with 3.6 gm. daily of calcium lactate, furnishing about 0.77 gm. of CaO.

The calcium balances in the foreperiod were positive in 3 of the 4 boys. In the first part of the main period the negative balance of the other boy became positive and there was a slight increase in the positive balance of the other subjects, but at the end of the period the balances were only slightly higher than during the foreperiod. These results are thought to indicate that, on a diet furnishing as much calcium as that of the present, nothing is to be gained by supplementing the diet still further with calcium salts.

Studies on the importance of zinc in animal nutrition.—Experiments on mice [trans. title], G. BERTRAND and B. BENZON (*Bul. Soc. Chim. Biol.*, 6 (1924), No. 3, pp. 203-216, figs. 6; also in *Ann. Inst. Pasteur*, 38 (1924), No. 5, pp. 405-419, figs. 6).—This is a complete report of an investigation which has been noted previously from another source (*E. S. R.*, 48, p. 63).

Experimental studies on the influence of cell salts on intermediary metabolism [trans. title], K. TADENUMA (*Biochem. Ztschr.*, 145 (1924), No. 5-6, pp. 481-491).—In the experimental work reported in this paper, 11 dogs were fed diets properly balanced except for salts and during alternate periods of about 5 days each were given suitable amounts of common salt and of a salt mixture considered to correspond as closely as possible to that of the body fluids. The dogs were weighed daily, and samples of the blood were analyzed for residual nitrogen, sugar, fat, and dry substance. The results obtained are summarized as follows:

Cell salt deprivation resulted in a loss of body weight, an increase in the residual nitrogen of the blood, a slight increase in blood sugar, only slight fluctuations in the neutral fat content of the blood, and no alteration or a tendency to a slight increase in the dry substance. In undernourished dogs, which were losing weight during the period of salt addition, the residual nitrogen of the blood remained constant and the blood sugar and fat increased, while during the salt-free period there was a greater loss in body weight, the residual nitrogen of the blood increased, there were no significant differences in the blood sugar and dry substance, and there was a slight increase in the blood fat.

The results are compared with those reported in the literature on the composition of the blood during starvation and during avitaminosis, and it is pointed out that the blood composition of the dog on a calorically sufficient but salt-free diet resembles that of avitaminosis with the exception of the content of blood fat, which is more markedly increased in avitaminosis. The composition of the blood of fasting dogs differs from the above in that the blood fat is decreased.

Antineuritic vitamin in poultry flesh and eggs, R. HOAGLAND and A. R. LEE (*Jour. Agr. Research* [*U. S.*], 28 (1924), No. 5, pp. 461-472).—Using the general technique employed by the senior author in a previous study of the antineuritic value of meat (*E. S. R.*, 50, p. 859), the authors have tested dried poultry flesh and eggs for their content of antineuritic vitamin as determined by the amount required in a ration with polished rice to protect a pen of four pigeons against the development of polyneuritis and loss in weight during a test period of 56 days.

On autoclaved rice alone the average survival period was 25 days with a loss in weight of 22.6 per cent. In general the poultry flesh was very low in antineuritic vitamin. The flesh of hens was the lowest, of turkeys and frying chickens slightly higher, guinea fowls still higher, and ducks the highest of all. The dried duck flesh, when fed to the extent of 30 per cent of the ration, afforded protection against polyneuritis and prevented serious loss in weight. Hens' gizzards afforded no protection when fed to the extent of 20 per cent of the ration, but hens' livers fed in the same amount afforded complete protection and brought about slight gains in weight.

With dried eggs to the extent of 25 and 30 per cent of the ration, only 2 out of 48 pigeons survived the test period of 56 days. The average survival period was 24 days, and the average loss in weight 2.9 per cent. In two experiments, in which eggs boiled for 7 minutes and then dried were fed at 15 and 30 per cent levels, the average survival periods were 26 and 40 days and the loss in

weight 21.4 and 19.2 per cent, respectively. This is thought to indicate a slight reduction in the antineuritic vitamin content of eggs on cooking.

Food accessory factors (vitamines) in bacterial growth.—IX, Growth of several common bacteria in a synthetic medium and relation of substances formed by them to growth of yeast, R. C. ROBERTSON (*Jour. Infect. Diseases*, 35 (1924), No. 3, pp. 311–314).—In this extension of work noted in the previous paper of the series (E. S. R., 51, p. 667) various organisms, pathogenic and nonpathogenic, were inoculated on the synthetic medium previously described and, where growth took place, were transplanted through the fiftieth generation. Continued growth was obtained with *Bacillus coli communis*, *B. prodigiosus*, *B. proteus*, *B. pyocyaneus*, *B. subtilis*, *Sarcina lutea*, and controls (nutrient broth); but growth ceased after a few transplants with *B. diphtheriae*, *B. dysenteriae*, *B. typhosus*, *B. paratyphosus* A and B, *Staphylococcus albus* and *S. aureus*, *Spirillum cholerae*, *S. metchnikovi*, and *Saccharomyces cerevisiae* (baker's yeast).

The fifty-first generation of all the organisms which had continued to grow through the successive transplants was transferred to a liter of the same medium. This was incubated for 10 days, after which it was filtered, titrated, tubed, and autoclaved. On the medium thus treated, yeast was grown through 50 generations.

These results are thought to indicate that the organisms whose growth was continuous on the synthetic medium formed during their growth substances essential to the growth of yeast. It is pointed out that further work in animal feeding is required to establish the relationship of these substances to any of the recognized vitamins.

Studies in bacterial metabolism, LXX–LXXII, A. I. KENDALL and R. C. HANER (*Jour. Infect. Diseases*, 35 (1924), No. 1, pp. 67–104, figs. 22).—In continuation of the series previously noted (E. S. R., 49, p. 610), three papers are presented.

LXX. *Micrococcus ovalis*.—The cultural and morphological characteristics of *M. ovalis* are reviewed, and data are presented on its fermentation reactions with various carbohydrates and its nitrogenous metabolism in various media. The results of the latter study show that the organism is not proteolytic in the usual sense of the word. On ordinary nitrogenous sugar-free media it grows but feebly, but on media containing carbohydrate it grows freely, forming considerable amounts of lactic acid.

“The observations recorded above would seem to justify the belief that *M. ovalis* and its variants are normal intestinal microbes of the obligate, or nearly obligate, lactic acid forming type. Their restriction to the upper segments of the intestinal tract in the nursing and artificially fed child is not wholly clear, although current information justified this statement. In the adult, however, the duodenal habitat can be definitely associated with the dietary status of the host. In this region, but not necessarily below, available carbohydrate is practically always present if the host is enjoying a mixed diet. The relatively rapid absorption of carbohydrate from the lower levels of the intestinal tract results as a rule in a protein-rich, carbohydrate-free intestinal content, which is unfavorable for the development of the enterococcus.”

LXXI. *Bacillus bifidus*.—A study similar to the above is reported for three strains of *B. bifidus* isolated from the feces of normal nursing infants. The three strains differed chiefly in their fermentation reactions. The more commonly occurring Type I did not ferment dextrin. Types I and II differed from Type III in ability to ferment the hexose alcohols, mannitol and sorbitol. Lactose was readily fermented by all strains and sucrose somewhat less readily.

The three strains were practically identical in their reaction on the protein media, growing feebly on such media in the absence of carbohydrate. There was no apparent action on amino acids containing aromatic nuclei. On this ground *B. bifidus* is considered to be theoretically at least a suitable organism for intestinal implantation. On account of its greater difficulty in isolation and cultivation it will, however, probably compete unfavorably with *B. acidophilus*.

LXXII. *Bacillus acidophilus*.—The data reported in this study, similar in scope to the two noted above, are prefaced by a discussion of the principles of lactic acid therapy. These are outlined as "(1) a microbic culture suitable for, and acclimatized to, intestinal conditions in man, (2) a properly modified diet to reduce protein residua in the human alimentary canal to relatively small amounts, and a carbohydrate regimen so adjusted as to provide a continuous supply of this absolutely necessary type of foodstuff throughout the small and large intestines to at least the sigmoid flexure, (3) the absence of a contraindication to a carbohydrate rich diet."

The fermentation and metabolism studies were conducted on three types of *B. acidophilus* isolated from a number of specimens. These were culturally almost identical, but differed in fermentation reactions, one fermenting sorbitol and mannitol and the other two not. All fermented dextrin and the di- and mono-saccharides. The data on quantitative nitrogen metabolism showed for the three strains no changes other than a slight increase in the protein nitrogen fraction and a decrease in the polypeptide fraction, and no material change in the ammonia and amino nitrogen fractions.

"This is significant in light of the relation between a carbohydrate-rich, protein-poor diet, which encourages the aciduric group in the human intestinal tract, and the nature of the regimen which must be pursued to induce successful growths of acidophili in an implantation therapy. The true secret of acidophilic and other lactic acid therapy is not to emphasize the administration of the microbe, but to regard the proliferation of the microbe in the intestinal tract merely as an indication of the establishment of a correct and successful regimen. From the point of view of the host, the dietary condition in the alimentary canal rather than the microbe is the goal to attain."

Relation of reaction of intestinal contents to diet and flora, N. P. HUDSON and L. W. PARR (*Jour. Infect. Diseases*, 34 (1924), No. 6, pp. 621-624).—Four groups of 4 rats each were fed diets of lactose, milk, and bread; meat 3 parts, lactose 1 part, and water; meat and water; and carrots, bread, oats, and water. At the end of from 7 to 10 days the animals were killed, and an examination was made of the bacterial flora and the reaction of the contents of the cecum and descending colon. In determining the reaction of the feces, both centrifuging and filtering through Mandler and Berkefeld filters were used to obtain clear liquids. A considerable discrepancy in results was obtained, particularly in the more acid samples, indicating that the weakly alkaline nature of the filter introduces a source of error by altering the reaction of the liquid being filtered.

In the rats on the high protein and stock diets there was a marked predominance of the *Bacillus coli* over the aciduric group. There was also a predominance of intestinal spirochetes, especially in the cecum, in the rats on the high protein diet. The ratio of the *B. coli* group to the aciduric group was low in the carbohydrate-fed rats, and intestinal spirochetes were absent in 3 of the 4 rats on this diet.

In the centrifuged specimens the reaction of the cecal contents of the rats on the straight meat diet and stock diet was nearly neutral, averaging pH 6.8, while the contents of the colon averaged pH 6.6. With lactose added to the

meat the cecal contents averaged pH 6.4 and the colon contents pH 6.9. In the rats fed on a high carbohydrate diet the cecal material averaged pH 4.8 and the colon material pH 5.8.

Occurrence of *Bacillus botulinus* in human and animal excreta, E. J. EASTON and K. F. MEYER (*Jour. Infect. Diseases*, 35 (1924), No. 2, pp. 207-212).—The conclusion drawn in an earlier study, that animal excreta contribute relatively little to pollution of the soil with *B. botulinus* (E. S. R., 49, p. 860), has been confirmed by the results of an examination of the stools of 88 healthy persons and 50 samples of animal excreta from widely separated areas of California.

In none of the human stools examined and in only 5 of the 50 specimens of animal excreta was *B. botulinus* found. The excreta from three hogs and two cattle contained *B. botulinus* type A.

Isolation of *B. botulinus*, type B, from feces by use of blood agar plates in anaerobic jar, M. W. WHEELER and E. M. HUMPHREYS (*Jour. Infect. Diseases*, 35 (1924), No. 3, pp. 305-310).—The authors report the demonstration of the presence of botulinus toxin type B in cultures inoculated with a small specimen of feces from a typical case of botulism and the successful isolation of the organism from the culture containing the toxin.

A preliminary enrichment medium, Hitchens' medium, consisting of 0.2 per cent dextrose infusion broth containing 0.1 per cent agar, was used, followed by subculture into chopped meat medium. Following unsuccessful attempts to isolate the organism from the toxic meat cultures by the use of deep agar dilution cultures in dextrose infusion agar, it was finally obtained in pure culture by the use of 5 per cent horse blood extract agar plates incubated in a hydrogen anaerobic jar. On this medium prepared with extract agar, 0.5 per cent dextrose extract agar, and 0.5 per cent dextrose infusion agar, different strains of the same species of anaerobes were found to produce colonies with characteristics typical of the species. Of the three media, the two containing dextrose proved most satisfactory.

Optimum and limiting hydrogen-ion concentrations for *B. botulinus* and quantitative estimation of its growth, C. C. DOZIER (*Jour. Infect. Diseases*, 35 (1924), No. 2, pp. 105-133, figs. 7).—This is a report, with many references to the literature, of an extensive investigation of the optimum nutritional substances for the growth of *Bacillus botulinus* and particularly of the optimum range of H-ion concentration for its growth in the most suitable media and under carefully controlled conditions of time, temperature, etc.

In the medium selected as most suitable, phosphate-buffered double strength veal infusion 2 per cent Difco peptone, the optimum range of H-ion concentration for the growth of vegetative forms was from pH 6 to 8.2, inclusive, with a mean near pH 7 and a limiting range for three-day growths of from pH 5 to 9, inclusive. The optimum range for spore inoculums was from pH 6 to 7.2, thus indicating that a slight acidity is a stimulus to spore germination. With increasing temperature from room temperature to 37° C. (98.6° F.), there appeared to be more rapid growth of the organisms and a greater production of toxin.

A study is also reported of the growth of vegetative and spore inoculums of *B. botulinus* in canned peas, corn, string beans, and spinach, with reaction unchanged and in the same media with acidity neutralized before sterilization. The pH values of the unchanged media were peas 5.88, corn 6.40, beans 5.36, and spinach 5, and of the same media with the acidity neutralized so far as possible 7.05, 7.13, 5.85, and 5.94, respectively. Each of the media in which the acidity had been partially neutralized showed growth, most abundant

in the peas and spinach and least in the corn and beans. In the natural media growth was less vigorous with all except the corn. No growth was evident with the spinach. It is concluded that the most active limiting factor in the growth of *B. botulinus* in vegetable media is the natural acidity of the medium.

Inhibitive influence of sugars and salt on viability, growth, and toxin production of *B. botulinus*, C. C. DOZIER (*Jour. Infect. Diseases*, 35 (1924), No. 2, pp. 134-155, figs. 2).—In the standard medium used in the above study no strain of *Bacillus botulinus* grew actively in the presence of more than 8 per cent of sodium chloride or 50 per cent of sucrose, and with most of the strains no growth occurred in concentrations greater than 6 per cent of sodium chloride. In salt solutions in which growth had not occurred, both heated spores and vegetative forms began to lose their viability after an incubation period of from 30 to 60 days.

A comparison of the growth of cultures with toxin production has shown that the latter is not a reliable criterion of active growth of the organism. Although growth ceased in media containing 55 per cent or more of sucrose, toxin was present in media containing as much as 70 per cent of sucrose when inoculated with *B. botulinus* and incubated for from 10 to 30 days at room temperature or at 37° C. (98.6° F.). The following theory of toxin formation is advanced:

"It seems not unlikely that toxin production in *B. botulinus* cultures is a function of enzyme action. The young growing cells are rich in the synthesized toxic substance which is readily given up under osmotic influences. Older cultures in which this preformed toxin is more closely bound in the cells liberate it only through cell autolysis. The enzyme or enzymes which probably are responsible for toxin production seem to be able to resist the heat which destroys the toxin."

Resistance of spores of *B. botulinus* to disinfectants, C. C. DOZIER (*Jour. Infect. Diseases*, 35 (1924), No. 2, pp. 156-176).—An exhaustive study is reported, with many references to the literature, of the effect of various common disinfectants on spores of *Bacillus botulinus* under varying conditions. The most effective disinfectant from the standpoint of the chemical sterilization of laboratory utensils contaminated with *B. botulinus* is considered to be 10 per cent hydrochloric acid, which at room temperature can be depended upon to destroy all *B. botulinus* spores within an hour. If a longer time can be allowed for sterilization, the use of commercial formalin diluted with equal volumes of warm water and allowed to act for a period of at least 24 hours is recommended. It is thought probable that at from 60 to 70° C. a shorter time would suffice.

Thyroid survey of 47,493 elementary-school children in Cincinnati, R. OLESEN (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 30, pp. 1777-1802, figs. 11).—The survey reported was conducted by a representative of the U. S. Public Health Service working cooperatively with district physicians of the city health department. A preliminary discussion of the meaning of the term goiter and of the methods employed in determining and recording the extent of thyroid enlargement is followed by a detailed report, with tabulated data, of the results of the survey. Particular attention was paid to the relative incidence of thyroid enlargement among boys and girls at different ages.

Of the 23,710 boys examined 26.6 per cent and of the 23,783 girls 39.8 per cent had some degree of thyroid enlargement, the maximum prevalence being at the ages of 11 and 12. The numbers with very slight enlargements were approximately the same for both sexes at the different age levels, but the very

marked enlargements were much higher among the girls than the boys, particularly at the ages of 15 and 16.

As an outcome of this survey a recommendation has been made to the Cincinnati board of health that all table salt used in the city be iodized to the extent of 1 part of an iodine compound, such as sodium iodide, to 5,000 parts of salt.

Thyroid enlargement among Montana school children, F. T. FOARD (*Pub. Health Rpts. [U. S.], 39 (1924), No. 37, pp. 2354-2358*).—The examination of 13,937 school children from different counties in Montana located in the Rocky Mountains and at varying distances to more than 100 miles east of them showed an average prevalence of simple goiter (excluding doubtful cases) of 21.6 per cent, with minimum and maximum figures for the separate counties of 9 and 37.2 per cent. The numbers having thyroid enlargement were largest among the children living in rural districts, where wells and springs were used for water supplies and where only locally grown vegetables were used, and were lowest among those living in cities and towns, where the water supplies came from surface streams and where imported fresh and canned vegetables were used. In both rural and urban communities, the nearer the location to the Rocky Mountains or tributary ranges the greater was the prevalence of goiter.

Thyroid enlargement among Minnesota school children, R. OLESEN and T. CLARK (*Pub. Health Rpts. [U. S.], 39 (1924), No. 41, pp. 2561-2572, figs. 3*).—A survey similar to the above was conducted on 4,061 children in 13 localities in Minnesota. Of both boys and girls 57.9 per cent had some degree of thyroid enlargement, the rate for girls being 71 and for boys 40.9 per cent. Slight, moderate, and marked enlargements were present among the boys to the extent of 35, 5.6, and 0.3 per cent, and among the girls to the extent of 47, 22, and 1.9 per cent, respectively. It is concluded that there is sufficient thyroid enlargement among the school children examined to warrant iodine prophylaxis.

ANIMAL PRODUCTION

The valuation of foodstuffs for animal production on the basis of energy, protein, and economy [trans. title], Y. BUCHHOLZ (*Tidsskr. Norske Landbr., 30 (1923), Nos. 8, pp. 286-296; 10, pp. 417-438; 11, pp. 465-489; 12, pp. 508-512*).—The author gives an extensive review of the principles of nutrition, dealing with chemical changes in the different nutrients during digestion and the substitutions of one feed for another in the ration. Certain suggestions are given of desirable changes in the methods of calculating rations to conform better to the Scandinavian requirements.

The influence of the antenatal feeding of parent rats upon the number, weight, and composition of the young at birth, V. KORENCHEVSKY and M. CARR (*Biochem. Jour., 17 (1923), No. 4-5, pp. 597-599*).—In experiments at the Lister Institute, 30 litters of rats were produced from sires and dams which had received the following diets: Milk, cabbage, oats, bran, and white bread; the above ration plus butter and cod liver oil and containing 0.52 per cent of calcium and 0.5 per cent of phosphorus in the fresh diet; and the above basal diet plus cottonseed oil and 0.25 per cent of calcium. The young were killed at birth and after removing the stomach and intestines were weighed and analyzed for water, calcium, phosphorus, and nitrogen content.

The results indicated that the diets of the sires before conception had no influence on the number, weight, or composition of the young at birth, but where the mothers were kept on normal diets containing an excess of the fat-soluble vitamin and calcium they produced larger and heavier litters than on

the other rations. A larger number of young were born dead with mothers receiving deficient diets, but the water, calcium, phosphorus, and nitrogen content of the young at birth was nearly the same irrespective of the mother's previous diet.

The composition, feeding value, and use of green forage silage [trans. title], N. HANSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet [Sweden] No. 234 (1922), pp. 26, fig. 1*).—Several years' experiments dealing with the food value and availability of green forage silage have shown that green forage as well as aftermath make good silage for milch cows. The inclusion of legumes in amounts of 30 to 50 per cent is desirable. In making the silage, it is cut into short lengths and thoroughly packed to exclude the air for the best preservation. The composition resembles that of the green forage from which it is made, though, due to the loss of water and fermentation, certain changes occur.

Feeding experiments have indicated that about 7 to 7.5 kg. of well ensiled aftermath and 6.5 kg. of green forage silage consisting of from 30 to 50 per cent of legumes are equal to a fodder unit. The value of silage composed of barley or oats is not so high. Feeding experiments have further indicated that from 15 to 25 kg. of green forage silage can be fed to milch cows daily as substitutes for roots, hay, and straw and to some extent for the concentrates when the silage includes legumes. The use of milk from cows receiving the silage has, however, been found unsatisfactory for the production of Emmental cheese.

The paper is abstracted in English.

A contribution to the study of grass silage and its relation to milk and its products.—I, Investigation of the water content and acidity of grass silage [trans. title], G. FASCETTI (*Ann. Ist. Sper. Caseif. Lodi, 2 (1923), No. 3-4, pp. 57-86, pl. 1*).—Analyses of grass silage for water and fixed and volatile acid content from seven different silos are reported. Some of the material was ensiled green, and the rest was put into the silos according to the Italian method when it contained less than 40 per cent of water.

The two types of silage were found to differ in their contents of water, amount of free volatile acids, and the kinds of volatile acids. In the dried hay silage the volatile acids consisted largely of those containing 2 to 4 atoms of carbon, while those in the green silage mostly contained 4 to 6 atoms of carbon. The length of the preservation period tended to increase the acetic acid content in the drier hay silage, which was due largely to a delayed fermentation. The water content of the silage also influenced the acidity.

Bran and pollard: Their relative composition and qualities, L. D. FOSTER (*New Zeal. Jour. Agr., 28 (1924), No. 5, pp. 315-319*).—This is mainly a popular discussion of the differences between wheat bran and pollards, with reference to the composition and feeding value of each.

Analyses of commercial feeding stuffs and registrations for 1924, C. S. CATHCART (*New Jersey Stat. Bul. 399 (1924), pp. 76, fig. 1*).—This is the usual report of the analyses of feeding stuffs inspected in the State during 1923 (E. S. R., 50, p. 367) giving among other data the protein, fat, and fiber content of the different feeds and the guaranties and analyses of the mixtures.

Commercial feeding stuffs, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul. 237 (1924), pp. 3-20*).—As in the previous report of the inspection of commercial feeding stuffs (E. S. R., 50, p. 367), the brands meeting their guaranties are listed and the guaranteed and found analyses of those showing deficiencies are tabulated.

The principal breeds of livestock of New Caledonia and Australia [trans. title], C. MANETTI (*Agr. Colon. [Italy], 18 (1924), Nos. 2, pp. 41-56; 3, pp. 86-*

105; 4, pp. 135-147).—The breeds of livestock and poultry in Australia, New Zealand, and New Caledonia are described with reference to the factors influencing livestock production on each island.

Proceedings of the twentieth annual convention of the Corn Belt Meat Producers' Association and of the fourth annual convention of Iowa Co-operative Livestock Shippers (*Corn Belt Meat Prod. Assoc. [etc.] Proc.*, 20 (1923), pp. 112).—This includes the following papers: The Future of Co-operative Livestock Marketing, by L. H. Goddard; Experiences and Observations, by J. M. Evvard; What Makes Iowa Great, by R. H. Holbrook; The Chicago Rate Case, by W. N. Cave; National Livestock and Meat Board, by R. M. Gunn; and addresses by A. Sykes, Kalsem, W. Cave, H. C. Wallace, and H. H. Kildee, given at the cooperative meetings of the Corn Belt Meat Producers' Association and the Iowa Co-operative Livestock Shippers held at Des Moines, Iowa, December 11 and 12, 1923.

The ratio of carbon dioxide to heat production in cattle, W. W. BRAMAN (*Jour. Biol. Chem.*, 60 (1924), No. 1, pp. 79-88, fig. 1).—The results of 35 calorimetry experiments with cows receiving from 0 to 25 gm. of feed per kilogram of live weight have been combined with the previous results dealing with the carbon dioxide:heat ratio in cattle (E. S. R., 44, p. 68), and the earlier equations have been slightly modified, as follows:

$$y_1 = 0.776x + 15.061$$

$$y_2 = 0.420x + 4.759$$

$$y_3 = -0.02886x + 2.883$$

in which x equals the air-dry weight of the feed in grams per kilogram of live weight, y_1 equals the calories of measured heat per kilogram of live weight, y_2 equals the grams of CO_2 produced per kilogram of live weight, and y_3 equals the heat:carbon dioxide ratio. The feed consumption, carbon dioxide and heat production, as well as the carbon dioxide:heat ratio, and the calculated heat and percentage relation between the observed and calculated heat were tabulated for each of the 134 animals. In all but 35 cases the latter figure was between 95 and 105 per cent and for the 7 fasting animals 104 to 112 per cent, suggesting that the mathematical equation should indicate a line slightly curved for very low feeding or fasting.

Graphical presentation of the results showed that as the feed increases in amount, the heat produced does not increase as rapidly as the amount of carbon dioxide produced, the maximum CO_2 :heat ratio occurring at fasting. Slight modifications in the CO_2 :heat ratio are likely to result from different kinds of feed. The equations are also applied to the results of some of Kellner's early work in which the heat produced was indirectly calculated.

Winter steer feeding, 1922-1923, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul.* 281 (1924), pp. 22, fig. 1).—This is a more complete report of the experiments previously noted (E. S. R., 51, p. 868). The rations fed consisted of lot 1 shelled corn, soy bean oil meal, corn silage, clover hay, and salt; lot 2 shelled corn, soy beans, corn silage, clover hay, and salt; lot 3 shelled corn, soy beans, corn silage, clover hay, and a mineral mixture; lot 4 shelled corn, cottonseed meal, corn silage, clover hay, and salt; lot 5 corn silage, cottonseed meal, and clover hay for 90 days, with the addition of a full feed of shelled corn to this ration for 150 days, and salt; lot 6 corn silage and clover hay for 90 days, followed by the addition of shelled corn full fed for 150 days, and salt; and lot 7 shelled corn, corn silage, clover hay, and salt. Lots 5 and 6 were fed for 8 months, while the rest of the cattle were heavier and were finished in 5 months. The following table gives a more detailed summary of the results:

Summary of Indiana 1922-23 winter steer feeding trials

Lot	Average initial weight	Average daily gain	Feed consumed per pound of gain						Selling price per 100 lbs.	Estimated value of pork produced from droppings
			Shelled corn	Cottonseed meal	Soy bean oil meal	Whole soy beans	Corn silage	Clover hay		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
1	946	2.17	5.77	-----	1.19	-----	13.60	1.15	\$8.50	\$82.88
2	945	2.25	5.59	-----	-----	1.15	13.31	1.33	8.50	90.96
3	949	2.13	5.89	-----	-----	1.21	14.00	1.57	8.55	85.78
4	946	2.16	5.80	1.24	-----	-----	14.10	1.63	8.35	51.56
5	765	2.09	3.76	1.14	-----	-----	14.50	1.55	9.70	52.30
6	766	1.86	4.23	-----	-----	-----	16.81	2.31	8.95	55.44
7	947	1.92	6.56	-----	-----	-----	16.30	1.41	8.10	48.96

¹ A mineral mixture consisting of equal parts of salt, acid phosphate, and pulverized limestone replaced the salt which was before the other lots at all times.

Steer feeding experiments, C. J. GOODELL (*Mississippi Sta. Bul. 222 (1924), pp. 16, fig. 1*).—The results of three steer feeding experiments are briefly noted.

Corn silage v. corn and soy bean silage.—In this trial conducted in 1916-17, two lots of 2-year-old steers were used for comparing corn and corn and soy bean silage in a 120-day test. Both lots also received cottonseed meal in amounts of 2 lbs. per day, which was gradually increased to 6 lbs. as the test progressed. The lot receiving corn silage made average daily gains of 1.99 lbs. as compared with 2.15 lbs. by the lot receiving corn and soy bean silage. The latter lot also consumed less cottonseed meal and less silage in making the greater gains, but the former lot was a little better finished.

Velvet bean-and-pod meal, cottonseed meal, and varying proportions of corn and velvet bean-and-pod meal for fattening steers.—Five lots of 8 steers each averaging about 1,000 lbs. in weight were selected for this test, which was conducted over a period of 140 days in 1917-18. All the lots received corn silage ad libitum and in addition lot 1 received cottonseed meal in increasing amounts of from 5 to 7 lbs. daily per 1,000 lbs. live weight. Lot 2 received from 10 to 14 lbs. of velvet bean-and-pod meal, while lots 3, 4, and 5 received, respectively, 2, 4, and 6 lbs. less of the latter feed than lot 2, with the substitution of 6.25 lbs. of broken ear corn for each 2 lbs. of velvet bean-and-pod meal replaced. The average daily gains of the lots 1 to 5 were, respectively, 1.90, 1.59, 1.62, 2.15, and 2.09 lbs. The amounts of silage consumed per steer were much reduced as the ear corn consumption increased, the average daily consumption of silage for lot 2 without corn being 72.03 lbs., but only 29.67 lbs. for lot 5, which received the maximum amount of corn.

The calculated profits over feed costs and the costs of the steers for the respective lots 1 to 5 were \$66.08, \$46.26, \$47.03, \$49.70, and \$43.42. Hogs following the steers in lots 2, 3, 4, and 5 also made good gains from the feed recovered.

Corn, sorghum, and sunflower silages.—The results of this experiment, conducted in 1921, were previously noted (E. S. R., 49, p. 465).

Africander cattle, T. G. W. REINECKE (*Union So. Africa Dept. Agr. Jour., 8 (1924), No. 6, pp. 583-593, figs. 6*).—This is a description of the characteristics and uses of Africander cattle.

Second report on sheep breeding (*Brit. Research Assoc. Woollen and Worsted Indus. Pub. 29 (1924), pp. 12*).—This is a continuation of the report of the joint committee consisting of representatives of the British Research Association for Woollen and Worsted Industries; the Universities of Leeds,

Edinburgh, and North Wales; the University College, Reading; Armstrong College, Newcastle; sheep breeders; and the Boards of Agriculture of England, Scotland, and Ireland (E. S. R., 48, p. 169).

Plans for the improvement of wool characters of Welsh sheep by selection are outlined. Southdown-Welsh crosses have been made to throw some light on the inheritance of fleece characters. The crosses of Scottish Blackface ewes with Southdown rams have produced 50 F₂ individuals of which the fleeces were generally intermediate between the two types. A microscopical study of the Blackface fleece has revealed three types of fibers, one having the character of a typical hair at its inner end, with characters of wool at the tip and an intermediate structure between. A second type is like wool at the tip and like the middle portion of the first fiber at its inner end. The third type has the characteristics of wool from root to tip. Two types of hair have also been observed in wild sheep, *Ovis ammon poli*, i. e., hair and wool, but *O. vignei* and *O. musimon* had a few fibers of an intermediate type.

In another study of the types of fibers in the Blackface sheep, three types were designated as kemp, hair, and wool. The report further states that breeding work is being started with Peruvian Merinos.

Sheep feeding.—XII, Fattening western lambs, 1923-1924, J. H. SKINNER and F. G. KING (*Indiana Sta. Bul.* 282 (1924), pp. 12).—This is a more detailed account of the lamb fattening experiments previously noted (E. S. R., 51, p. 870). The following rations were fed to the different lots during the 80-day experiment: Lot 1 shelled corn, soy bean oil meal, corn silage, and clover hay; lot 2 shelled corn, whole soy beans, corn silage, and clover hay; lot 3 shelled corn, whole soy beans, mineral mixture, corn silage, and clover hay; lot 4 shelled corn (self-fed), cottonseed meal, corn silage, and clover hay; lot 5 shelled corn (self-fed), cottonseed meal (self-fed), corn silage, and clover hay; lot 6 ear corn, cottonseed meal, corn silage, and clover hay; lot 7 shelled corn, cottonseed meal, corn silage, and clover hay; and lot 8 shelled corn, cottonseed meal, corn silage, and soy bean hay. A summary of the results is tabulated below:

Summary of 1923-24 lamb feeding trials at the Indiana Station

Lot	Average initial weight	Average daily gain	Feed consumed per pound of gain			Selling price per 100 lbs.	Estimated profit per lamb
			Concentrates	Silage	Hay		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		
1.....	68.4	0.303	4.20	3.72	5.28	\$12.70	\$-0.15
2.....	68.1	.312	4.06	3.60	5.12	12.80	.02
3.....	68.1	.291	4.36	3.87	5.45	12.55	-.46
4.....	68.4	.349	4.57	3.16	3.88	12.80	.31
5.....	68.2	.336	4.83	3.29	3.94	12.70	.05
6.....	68.2	.329	4.64	3.62	5.06	12.80	.15
7.....	68.2	.281	4.51	4.00	5.72	12.65	-.42
8.....	68.2	.293	4.34	3.85	5.65	12.80	.12

Forage crops for lambs, J. W. WILSON and A. H. KUHLMAN (*South Dakota Sta. Bul.* 207 (1924), pp. 661-673).—A summary of the results of two years' tests in comparing the gains made by lambs on different forage crops is given in the table below. The lambs were allowed 30 days pasturage on each crop, 12 lambs per acre being used in 1922 and 15 or 16 in 1923.

Summary of the comparison of forage crops

Forage crop	Average initial weight of lambs		Average gain per head		Forage crop	Average initial weight of lambs		Average gain per head	
	1922	1923	1922	1923		1922	1923	1922	1923
	Lbs.	Lbs.	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.
Corn.....	61	52	15	13	Sorghum.....	64	52	14	13
Corn and rape.....	66	52	16	16	Sudan grass.....	73	52	5	10
Corn and soy beans.....	59	51	16	14	Rape.....	64	52	10	8

Fattening and nutritional investigations with wether lambs in comparing urea with peanut cake [trans. title], W. VÖLTZ, H. JANTZON, and E. REISCH (*Landw. Jahrb.*, 59 (1924), No. 3, pp. 321-340).—The results of a 174-day lamb fattening test are reported from the University of Königsberg. The experimental animals consisted of two groups of 5 each and one group of 4 Oxford × Hampshire lambs of about 6 months of age, weighing approximately 32.5 kg. The average basal rations fed to all lots consisted of 0.52 kg. of hay, 4.51 kg. of fodder beets and a few potatoes, and a salt mixture. Group 1 received the basal ration only, whereas an average of 19 gm. of urea was given to group 2 per head daily, and group 3 received 145 gm. of peanut cake per head daily.

The composition and digestibility of the feeds used in the experiments were determined with 2 wethers. Based on these results, the digestible nutrients consumed by each lot of the fattening lambs were determined and tabulated in detail, as well as the slaughter records of the lambs. During the entire test the average gains made per lamb in groups 1, 2, and 3 were, respectively, 21.59, 22.11, and 27.87 kg. It was calculated that in making these gains group 1 required 0.56 kg. of digestible protein and 4.6 kg. of starch equivalent per kilogram of gain, whereas group 2 required 0.94 kg. of digestible protein and 4.72 kg. of starch equivalent, and group 3 required 0.81 kg. of digestible protein and 4.25 kg. of starch equivalent per kilogram of gain. The dressing percentages of the three lots were, respectively, 51.3, 53, and 54.7 per cent.

Potatoes as a feed for fattening pigs, J. W. WILSON and A. H. KUHLMAN (*South Dakota Sta. Bul.* 209 (1924), pp. 693-710, figs. 2).—The results are reported of four tests of the feeding value of raw and cooked potatoes as supplements to a ration of corn and tankage. The gains made by pigs on these rations are compared in each experiment with the gains made by another lot receiving corn and tankage either self-fed or hand-fed. The results of the four tests are summarized in the table following.

Summary of potato feeding experiments

Experiment	Lot	Number of pigs	Length of test	Average initial weight	Average daily gain	Feed consumed per 100 lbs. gain			
						Corn	Tankage	Cooked potatoes	Raw potatoes
			Days	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1-----	1	7	56	142	2.10	372.6	18.4	-----	-----
	2	7	56	142	1.66	167.0	22.4	624.2	-----
	3	7	56	142	.66	207.0	56.8	-----	483.7
	4	7	56	141	.40	336.7	-----	-----	763.9
2-----	5	8	56	86	.84	510.7	29.9	-----	-----
	6	8	56	86	.87	226.8	28.6	876.2	-----
	7	8	56	85	.45	250.0	55.4	-----	935.1
3-----	8	9	40	151	1.11	602.5	26.0	-----	-----
	9	9	40	150	1.10	352.0	26.3	967.2	-----
4-----	10	5	86	73	1.47	373.7	46.2	-----	-----
	11	5	110	72	1.16	252.0	125.2	609.1	-----

¹ The tankage was fed during the first 70 days, while an average of 24.4 lbs. of a tankage, oil meal, alfalfa hay mixture was fed per 100 lbs. during the last 40 days.

The results indicated that cooked potatoes were palatable, and pigs receiving them made satisfactory gains. In three of the trials an average of 339 lbs. of cooked potatoes replaced 100 lbs. of shelled corn. On the other hand, raw potatoes were unpalatable, and it was difficult to get pigs to consume them in sufficient quantities. One gilt in lot 11 receiving cooked potatoes and a limited yellow corn ration developed symptoms of rickets, as did others in this lot until they were exposed to sunlight and furnished a supplement containing tankage, oil meal, and chopped alfalfa hay.

Analyses are reported of the raw and cooked potatoes.

Pigs and their management, H. W. POTTS (*Sydney, Aust.: Angus & Robertson, Ltd., 1923, 4. ed., rev. and enl., pp. [6]+230, pls. 32, figs. 28*).—This book deals with the breeds of swine, care, management, feeding, breeding, and diseases, as well as chapters on slaughtering and bacon curing.

Contribution toward the correlation between speed and massiveness of the horses [trans. title], R. PRAWOCHEŃSKI (*Rocz. Nauk Rolnicz., 11 (1924), No. 1, pp. 1-10*).—The English abstract of this article states that the author has made a study of the relationship between the track records and the index of capacity (relation of the weight of the horse to its height at withers, in 437 trotters. The correlation coefficient between these characters was 0.225 ± 0.03 . Based on these results and on results showing the locality of Russia in which the horses were raised, the author is inclined to think that the diminution in the size of race horses has not been brought about by selection for racing capacity but rather by the effects of environment. The heaviest trotters and the fastest ones were bred in the southeastern part of Russia which, it is stated, is noted for its dry climate and black limy soil.

The variability in weight of Leghorn chickens at hatching, thirty-five days, and maturity, H. B. LATIMER (*Amer. Nat., 58 (1924), No. 656, pp. 278-282*).—The results of a statistical study dealing with the variability and relationship of the weights of Single Comb White Leghorn chicks at hatching, 35 days of age, and when the pullets laid their first eggs are reported from the University of Nebraska. Based on the coefficients of variability obtained for the weights of the two sexes at the different periods, it is shown that the variability is greatest for the 35-day weight when the chicks were making most rapid growth.

The following coefficient correlations were calculated: Hatching weight and 35-day weight of males 0.2202 ± 0.0259 , hatching weight and 35-day weight of

females 0.1042 ± 0.0344 , 35-day weight and maturity weight of females 0.0061 ± 0.0436 , and 35-day weight and age at maturity of females -0.2672 ± 0.0407 . The author concludes that these results indicate little relationship between the hatching weight and the 35-day weight and between the latter and the weight at maturity. There was, however, a slight indication that the heavier fowls at 35 days of age would lay earlier.

The nutritional requirements of baby chicks.—IV, The chicks' requirement for vitamin A, E. B. HART, H. STEENBOCK, and S. LEPKOVSKY (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 341-354, figs. 9).—In continuing this series (E. S. R., 50, p. 780), the results of several experiments are cited which indicate that chicks need vitamin A for normal growth and nutrition. These results corroborate those of Emmett and Peacock (E. S. R., 50, p. 373), but are contrary to the conclusions of Sugiura and Benedict (E. S. R., 49, p. 160). In the early experiments it was found that normal growth followed the addition of 5 per cent of saponified cod liver oil to a basal synthetic ration, but little growth and early death occurred on the basal ration with or without radiation or the addition of 5 per cent of straight cod liver oil.

In further tests to eliminate the effect of the antirachitic vitamin, chicks received a basal synthetic ration with and without 1.5 per cent of clover dried in the dark, or radiation, or both. Growth was very successful when both the clover and radiation were supplied, but the effects of poor nutrition were very evident on the other rations and early death resulted.

In another test, lots of birds were fed in sunlight on a ration of corn 97, calcium carbonate 2, and sodium chloride 1 per cent, with skim milk ad libitum. Yellow corn was used for one lot and white corn for the other. The lot receiving white corn grew well for a time, but in less than 14 weeks the weights began to decline, with death following. The birds receiving yellow corn grew normally to maturity. The authors thus feel that the necessity of vitamin A for normal growth and nutrition in chicks has been demonstrated.

Breeding for increased egg production, P. G. RILEY (*Indiana Sta. Circ.* 119 (1924), pp. 15, figs. 11).—A popular discussion is given of the approved methods for producing pedigreed chicks and the general improvement of the egg production from the flock.

A statistical study of egg production in four breeds of the domestic fowl.—Part III, Egg production of Plymouth Rocks, L. C. DUNN (*Connecticut Storrs Sta. Bul.* 122 (1924), pp. 215-277, figs. 6).—This is the third part of the series of studies previously noted (E. S. R., 51, p. 874), and deals with the statistical analysis of the egg records of 655 Barred Plymouth Rock pullets completing a year's production in the nine international egg-laying contests held at Storrs from 1911 to 1919, with additional unanalyzed data on the 410 White Plymouth Rocks, 95 Buff Plymouth Rocks, and the 30 Columbian Plymouth Rocks entered in these contests.

The Barred Plymouth Rocks showed considerable variability in egg production, as did the Wyandottes and Rhode Island Reds previously analyzed. The annual production of individuals ranged from 1 to 282, averaging 163.05 ± 1.16 eggs. The average egg production undoubtedly increased considerably from year to year over the nine-year period, the exact amount depending upon the desirability of eliminating the results for years when environmental conditions were unfavorable, 3.3 eggs per year being the calculated increase when all the data were used. The monthly records for all years combined show gradual increases from November to February, with a high peak in March, April, and May, and fall to a lower level in July and August, with a sudden drop in October.

The average annual egg production of the White, Buff, and Columbian varieties of the Plymouth Rock was found to decrease slightly during the period of years studied.

Rules and regulations for the Utah Intermountain Egg-Laying Contest, B. ALDER (*Utah Sta. Circ.* 52 (1924), pp. 4).—This consists of the rules for, and information concerning, the egg-laying contest which is being conducted at the State agricultural college farm.

DAIRY FARMING—DAIRYING

The principles of dairying.—Testing and manufactures, H. F. JUDKINS (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1924, pp. XVII+279, figs. 73*).—This book deals with the physiology of milk secretion, testing, and factors affecting the composition of milk, the production of market milk and cream, and the manufacture of butter, cheese, ice cream, and miscellaneous dairy products.

A comparison of early, medium, and late maturing varieties of silage corn for milk production, G. C. WHITE, L. M. CHAPMAN, W. L. SLATE, JR., and B. A. BROWN (*Connecticut Storrs Sta. Bul.* 121 (1924), pp. 173-211, figs. 5).—A more complete report of the experiments previously noted (*E. S. R.*, 50, p. 474) is given, and in addition the results of a third similar trial conducted in 1922-23.

The composite results of the three years' work are similar to those derived from the first two years' experiments. The silage yields per acre were largest for late maturing and smallest for early maturing, with medium maturing corn giving intermediate yields. The amounts of additional grain required for milk production were greatest when late maturing silage was fed and least with early maturing silage, due to the larger amounts of grain in the silage.

The most economical type of corn to grow for silage on an individual farm will depend on various conditions, such as the availability of additional grain and roughage and other factors.

Judging cattle, G. PUSCH, rev. by H. ATTINGER (*Die Beurteilung des Rindes. Berlin: Paul Parey, 1923, 3 ed., rev. and enl., pp. XII+401, pl. 1, figs. 389*).—This book deals with the principles of judging cattle, based on their breeding, body form, and production. Many illustrations both of defective and desirable characters are included.

Some results of dairy improvement associations, G. W. TAILBY, JR. (*N. Y. Agr. Col. (Cornell) Ext. Bul.* 83 (1924), pp. 19, figs. 11).—This is a popular bulletin dealing mainly with the accomplishments and facts demonstrated by cow testing associations in New York State.

Relation of milk production to the twinning tendency, G. A. HUNT (*Jour. Dairy Sci.*, 7 (1924), No. 3, pp. 262-266).—A study at the Nebraska Experiment Station has shown that 55.7 per cent of the 165 dams of male or female and male twins listed in volume 35 of the Holstein-Friesian Herdbook have made Advanced Registry records, and 45.8 per cent of the 192 dams of female twins listed in volume 40 of the Herdbook have made A. R. O. records, as compared with a total of 20.4 per cent of all females registered in these volumes which have made records.

Based on breeders' estimates of the percentage of registered females not producing young, which varied from 2 to 12 per cent, the author corrected the percentage of females making records by the maximum estimate of 12 per cent to make 32.4 per cent. Other evidence in favor of a relationship between twinning and high milk production deals with the frequent occurrence of cen-

tury sires in twins' pedigrees and the milk and fat production records of certain twin cows.

The effect of an incomplete removal of milk from the udder on the quantity and composition of the milk produced during the immediate subsequent milkings, F. A. DAVIDSON (*Jour. Dairy Sci.*, 7 (1924), No. 3, pp. 267-293, figs. 16).—A preliminary investigation at the Illinois Experiment Station showed that returning a small portion (0.66 lb.) of the milk to one quarter of the udder markedly decreased the lactose percentage and increased the fat and the protein and ash content of the milk produced during the immediate subsequent milkings.

For further study of the effect of leaving milk in the udder, tests were conducted over a period of 4 months with 12 cows. In the first two trials of 19 and 17 milkings each, the 4 and 3 cows used, respectively, were milked twice daily and at the fifteenth milking in the first experiment one-fourth of the milk, based on the 7 previous corresponding milkings, was left in the udder. At the thirteenth milking of the second trial one-half of the milk was left in the udder.

A series of eight trials involving the use of 1 cow each milked four times daily was also carried on. There were 17 milkings each in these tests and one-half of the milk was left in the udder at the ninth milking. The analyses of the milk produced at each milking by each animal are reported in the form of tables and curves.

The changes in the composition of the milk produced by leaving a portion of the milk in the udder were not great in most cases, but their magnitude was apparently influenced by the relative amount of milk left in the udder and the length of time to the succeeding milking. Increases in both amount and time tended to increase the resulting changes in the composition. Among the author's conclusions from this study were the following:

"The average yield of milk and fat and the average percentage of fat in the milk tends to increase for the two days following an incomplete milking. The average percentage of lactose in the milk tends to decrease for the two days following an incomplete milking. The average percentage of protein plus ash in the milk is changed only very slightly during the two days following an incomplete milking. . . . The decrease in the percentage of lactose in the milk at any milking during the two days subsequent to an incomplete milking is not sufficient to permit the use of a sugar determination as a detective measure. Such a decrease, however, may be sufficient to justify suspicion."

The rate of milk secretion as affected by an accumulation of milk in the mammary gland, A. C. RAGSDALE, C. W. TURNER, and S. BRODY (*Jour. Dairy Sci.*, 7 (1924), No. 3, pp. 249-254, figs. 2).—In this study the average amounts of milk produced, the fat, solids content, and specific gravity of the milk of 2 Jerseys and 2 Ayrshires were recorded when the period after the preceding milkings varied from 1 to 36 hours. The experimental periods were 3 days in length, followed by 3 days of normal milking. The total experiment covered a period of about 3 months. The larger amounts of milk per unit of time were produced when the interval to the preceding milking was shortest. The production during each hour after the preceding milking was approximately 95 per cent of that during the preceding hour.

The curve illustrating the milk production, with periods of varying lengths between milkings, had the same shape as the curve representing the rate of change of a chemical reaction when the products formed are not removed. This indicates that milk secretion is a chemical process. Three and four milkings per day increased the total milk production 10 and 16 per cent, respectively, over two milkings a day.

In regard to the effect of the periods between milkings on the composition of the milk, it is stated that the percentage of fat and total solids gradually decreases with the lengthening of the interval between milkings until the interval exceeds 14 to 16 hours. When the interval exceeds this length, the fat and solids content increases up to 24 to 26 hours, followed by a gradual decline to the thirty-sixth hour. Some evidence indicates that the time of feeding also influences the fat content of the milk.

Unique dietary needs for lactation, H. M. EVANS (*Science*, 60 (1924), No. 1540, pp. 20-22, figs. 2).—The results are given of an experiment conducted at the University of California which indicate the presence in leaves, egg yolk, and meat of a substance necessary for maximum milk production in rats. The work has been carried on by the use of litters of rats produced by females receiving synthetic diets deficient in vitamin X, it being explained that first litters may be produced by rats even with the deficiency of this reproductive vitamin. The size, however, of the rats is only about one half that of rats produced on normal diets at weaning time.

By exchanging about 100 young produced on synthetic diets with an equal number from mothers receiving a table scrap diet, it has been shown that the young produced on the deficient diet have the same capacity to grow when suckled by foster mothers receiving a table scrap diet as do young produced by mothers on the table scrap diet. It has further been shown that the extraction of the fat from the substances containing this dietary factor for lactation does not reduce the value of the residue as a source of the factor.

The influence of diet and management of the cow upon the deposition of calcium in rats receiving a daily ration of the milk in their diet, M. A. BOAS and H. CHICK (*Biochem. Jour.*, 18 (1924), No. 2, pp. 433-447, figs. 3).—The results of a series of tests of the content in the vitamin aiding calcium and phosphorus assimilation of a cow receiving different diets and under different conditions are reported. In each experiment the calcium and phosphorus retention was determined for young rats receiving a basal ration lacking in vitamin A and the antirachitic vitamin, but to which 5 gm. daily of a sample of the milk to be tested were added. The milk, as drawn from the cow, was put in sterile bottles and the air displaced with carbon dioxide, after which it was pasteurized and kept in a refrigerator.

The milk used in the first experiment was collected about 6 months after the cow had been placed in a dark stall and was furnished with a ration consisting of dry feeds. The milk used in the second experiment was collected 2 months after the cow had been receiving a ration of fresh meadow grass and clover, the cow still being kept in the dark stall. The sample used for the third experiment was collected after the cow had been on grass pasture for 11 weeks.

The calcium retention of the rats was distinctly less during the first two experiments than for the control rats receiving a similar ration except that dried milk plus a small amount of cod liver oil was added to the ration instead of the fresh milk. The phosphorus retention was also reduced in these experiments. The amount of calcium retention was calculated at 34 per cent lower in the first experiment and 40 and 20 per cent lower in males and females, respectively, in the second experiment. The phosphorus retention was 11 per cent lower in the first experiment and 19 and 7 per cent lower for males and females, respectively, in the second experiment than for the controls.

In the third experiment, when the milk fed was produced by the cow on a sunny pasture, the calcium retention of the rats was equal to that of the controls, but the phosphorus retention was 15 per cent less with females though equal with males. In the first two experiments the ratio of the calcium to the

phosphorus retained was found to decrease steadily during the early weeks of life, whereas a steady increase is normally observed.

On the coagulation of milk by rennin, E. F. BOSTROM (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 6, pp. 301, 302).—In a study from the department of physiology, New York University and Bellevue Hospital Medical College, it has been found that the coagulation of milk by rennin is not a true precipitation reaction, since concentrated and dilute solutions of CaCl_2 , MgSO_4 , and NaCl do not have the same action in making milk coagulate.

The author concludes that these salts are dependent for operation on the extent to which they increase or decrease the surface charges of the colloids. Calcium caseinate has its isoelectric point at pH 10.53, and if a calcium compound is to assist in the clotting of milk, the milk must not be more alkaline. In a test of the first stage of clotting undisturbed by alkalis, in which the rennin was added after the calcium had been precipitated, it was found that the last stage of clotting would not occur unless the acidity of the milk was greater than pH 10. The first stage of clotting, i. e., the enzyme activity, did not take place when the milk was more alkaline than pH 6.9. This was also demonstrated to be due to other causes than the destruction of the enzyme.

The history of dairy bacteriology, C. C. WALTS (*Creamery and Milk Plant Mo.*, 13 (1924), No. 6, pp. 57-66).—This paper consists of a brief review of the history of dairy bacteriology, beginning with the discovery of bacteria by A. Van Loeuwenhock.

A critical investigation into the thermal death-point of the tubercle bacillus in milk, with special reference to its application to practical pasteurization, F. W. C. BROWN (*Lancet [London]*, 1923, II, No. 7, pp. 317-321).—The results of experiments dealing with the thermal death point of 15 strains of bovine tuberculosis and 10 strains of human tuberculosis are reported from the University of Aberdeen. It was found that though some variation in the resistance apparently existed between the different strains, all were either destroyed or sufficiently attenuated to be harmless by a temperature of 60°C . (140°F .) for 20 minutes or 70° for 5 minutes. The former temperature, however, is recommended because it produces the least changes chemically in the milk.

Observations on butter from buffalo milk [trans. title], M. DEGLI ATTI (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 18 (1923), [Art. 11], pp. 7).—The chemical analysis and quality of butter made from buffalo milk were compared with that made from cow's milk, and it was found that the latter was a slightly superior product.

Gouda or sweet-milk cheese-making, T. HAMILTON (*Rhodesia Agr. Jour.*, 21 (1924), No. 3, pp. 269-276, pls. 2, fig. 1).—The making of Gouda cheese is described.

Tenth annual report of the creamery license division for the year ending March 31, 1924, W. G. Goss (*Indiana Sta. Circ.* 118 (1924), pp. 16, figs. 2).—This is similar to the ninth report (E. S. R., 49, p. 878).

VETERINARY MEDICINE

Report of the proceedings of the Fifth Pan-African Veterinary Conference (Nairobi: Govt., 1924, pp. [2]+128+II, pls. 5).—The details of this conference, which was held at Nairobi, Kenya Colony, in April, 1923, are reported under the headings of 16 specific animal diseases (pp. 4-98), pathological research (pp. 99-102), disease control (pp. 102-106), etc.

Digest of comments on the Pharmacopoeia of the United States of America and on the National Formulary, A. G. DuMEZ (*U. S. Pub. Health*

Serv., Hyg. Lab. Bul. 137 (1924), pp. XIX+283).—This continues for 1921 the series previously noted (*E. S. R.*, 48, p. 480).

Toxicology or the effects of poisons, F. P. UNDERHILL (*Philadelphia: P. Blakiston's Son & Co., 1924, pp. IX+292*).—The first chapter of this reference book on the effects of poisons deals with the general principles of toxicology and the succeeding chapters with inorganic poisons, poisonous gases, metallic poisons, alkaloidal poisons, and miscellaneous organic poisons. The discussion of each poison includes the properties of the substance, symptoms and poisonous action, the fatal dose and time, post-mortem appearances, and treatment.

Cockleburs (species of *Xanthium*) as poisonous plants, C. D. MARSH, G. C. ROE, and A. B. CLAWSON (*U. S. Dept. Agr. Bul. 1274 (1924), pp. 24, pls. 4*).—The great importance of the question of the poisonous properties of cockleburs to stock raisers led to the experimental study here reported. A historical summary, first presented, is followed by a discussion of the cocklebur plant and a report of experimental work, the details of which are presented in tabular form.

The feeding experiments have shown conclusively that cocklebur plants are poisonous to swine, cattle, sheep, and chickens. While the burs may produce some mechanical injury and the seeds are very poisonous, stock poisoning is caused by feeding on the young plant before the development of the leaves. The toxic dosage has been worked out, together with the symptoms and lesions produced by the plant. It has been shown that beneficial remedial effects may be produced by the use of milk, oils, or fats. The bulletin includes a list of 47 references to the literature.

Note on the composition of various samples of arsenite of soda, J. P. VAN ZYL (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 9-10 (1923), pp. 775-780*).—The examination of 27 samples of sodium arsenite used for cattle dips has led to the conclusion that the most satisfactory samples should give at least 78 per cent As_2O_3 and 14 per cent Na_2O on analysis after boiling the coarsely powdered sample with four times its weight of water for two minutes. A warning is given against the practice of adding the sodium arsenite directly to the tank or of not getting it completely into solution before placing it in the tank.

Oxidation in arsenical dipping tanks, J. P. VAN ZYL (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research, 9-10 (1923), pp. 797-808, figs. 11*).—The analysis for arsenite and total arsenic of over 200 field samples of dipwashes from various sections of the Union of South Africa has led to the conclusion that arsenite dips containing phenols tend to oxidize more rapidly than those containing little or none of these substances. This is explained on the ground that under field conditions the concentration of the phenolic substances becomes adjusted more or less to the point of checking the development of the reducing organisms but not completely checking the oxidizing organisms. A few instances of purely chemical oxidation in the dips are recorded, but chemical oxidation is considered to be a less important factor than bacterial oxidation.

Attention is called to the necessity in the collection of samples of a thorough mixing of the solution. This is thought to be accomplished most readily by taking the samples immediately after several animals have been dipped.

Organic substances, sera, and vaccines in physiological therapeutics, D. W. C. JONES (*London: William Heinemann, 1924, pp. VIII+393*).—This practical treatise on organotherapy and vaccine and serum therapy, while concerned chiefly with human medicine, contains much of value to the veterinarian in its discussions of the general principles involved.

Immunologic significance of vitamins.—IV, Influence of lack of vitamin C on resistance of the guinea-pig to bacterial infection, on production of specific agglutinins, and on opsonic activity, C. H. WERKMAN, V. E. NELSON, and E. I. FULMER (*Jour. Infect. Diseases*, 34 (1924), No. 5, pp. 447-453).—In this continuation of the investigation previously noted (*E. S. R.*, 49, p. 279), the influence of lack of vitamin C on resistance to bacterial infection was tested in a manner similar to that described in a previous paper for vitamins A and B.

Healthy guinea pigs and others which had been on a scorbutic diet for from 5 to 6 weeks and were in a condition of acute scurvy were injected intraperitoneally with varying doses of virulent strains of pneumococci and anthrax bacilli, and comparisons were made of the number of deaths and survival periods of the scorbutic and control animals. The summarized results of four final series, two with pneumococcus and two with *Bacillus anthracis*, showed a mortality of 85 per cent among 34 scorbutic and of 74 per cent among 43 control animals. The average length of time before death was 2.4 days for the scorbutic and 3.6 for the controls.

A study of the agglutinin production and phagocytic activity of the blood showed no difference in the scorbutic animals as compared with the controls.

The authors conclude that there is a definite though not a marked decrease in resistance to infection in guinea pigs suffering from lack of vitamin C, and suggest that this is due chiefly to lowered body temperature.

The discovery of the casual organism of foot-and-mouth disease [trans. title], [P.] FROSCHE and H. DAHMEN (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), Nos. 15, pp. 185-187; 21, pp. 273-275; abs. in *Jour. Compar. Path. and Ther.*, 37 (1924), No. 2, pp. 134-136).—This is an account of investigations conducted by the authors and terminating in the discovery of the causal organism of foot-and-mouth disease, which was presented at a meeting of the Berlin Microbiological Society, held on April 7, 1924, and the discussion which followed at a meeting on May 19. The cultivation of the organism is dealt with by Dahmen and its morphology by Frosch.

The work was commenced in April, 1923, with a strain from the Island of Riems, and up to November, 1923, Dahmen had succeeded in cultivating the virus on a solid culture medium through the thirteenth generation and in producing the disease in guinea pigs with it. In January, 1924, another strain of the virus was obtained from the Institute of Infectious Diseases which was carried through 7 generations, while the first strain had passed through 25 generations. The disease was produced in guinea pigs on March 17 with the twenty-third generation of the first strain and the fifth generation of the second strain. The solid culture medium used is composed of 3 per cent agar prepared with Martin's broth to which an equal amount of serum is added. By use of the ultraphotomicrographic apparatus, photographs were taken of the organism. Colonies grown upon solid media reach a size of 7 to 8 μ , though not infrequently they are but half this size. With the ultramicroscope the colonies are seen to be composed of minute rods, a little longer than wide, the smallest of which measures less than 0.1 μ . The new genus *Loeffleria* is erected for the organism, to which the name *L. nevermanni* is given. To date Dahmen has cultivated 6 strains from guinea pigs, 2 from cattle, and 2 from pigs. In an appended note Dahmen states that with the sixth generation of a culture on the solid medium, a cow was infected through scarification of the buccal membrane on March 28. On April 4 the disease was produced in a second cow through the saliva of the first animal.

The virus of foot-and-mouth disease (*Lancet* [London], 1924, I, No. 26, pp. 1329-1331).—This is a report of a lecture and demonstration given at

Utrecht on June 16 by P. Frosch and H. Dahmen, in response to an invitation from the Dutch Government. It deals with the methods of ultramicrophotography, cultivation, etc., as given in the paper above noted. It is pointed out that, after having succeeded in cultivating the agent on solid and liquid media under similar growing conditions, the authors were able to infect experimental animals with the fifth, thirteenth, and twenty-third subcultures.

The formation of antibodies following injections of mallein in the mule [trans. title], BROCC-ROUSSEU, FORGEOT, and A. URBAIN (*Ann. Inst. Pasteur*, 38 (1924), No. 5, pp. 420-426).—It is reported that an intradermal injection of 0.1 cc. of mallein of one-fourth strength or 2.5 cc. of one-tenth strength causes the appearance in the mule of a specific sensibilisin or allergin. This appears on the fifth to seventh day after the first injection of mallein, but after several injections can be detected on the third or fourth day. The antibodies formed in the organism reach high values. The time required for the disappearance of these antibodies is variable, oscillating between 37 and 113 days.

It is concluded that if the mallein test is to be associated with the complement deviation test in the diagnosis of glanders in mules the blood should be taken before malleination or before the fifth day after the first malleination, or the third day after several injections of mallein.

Attempts at vaccination against tuberculosis by ingestion in small laboratory animals [trans. title], A. CALMETTE, A. BOQUET, and L. NÈGRE (*Ann. Inst. Pasteur*, 38 (1924), No. 5, pp. 399-404).—Experiments are reported which indicate that a considerable degree of protection against artificial infection with bovine tuberculosis by the same route can be conferred on young rabbits and guinea pigs by the repeated ingestion at 24-hour intervals of from 10 to 20 mg. of bile-treated bacilli (B. C. G.).

Studies in tuberculosis immunity.—I, Diagnostic and sensitizing properties of some new derivatives of tuberculin, F. EBERSON (*Soc. Expt. Biol. and Med.*, 21 (1924), No. 8, pp. 539-543).—A brief report is given of a preliminary study of the sensitizing properties of three derivatives of Old Tuberculin, the preparation of which is to be described in a later paper. These derivatives, which include an acetyl, a benzoyl, and an alcohol-soluble, ether-precipitable substance called ether-insoluble X, have been compared with untreated tuberculin in the reactions obtained by intracutaneous injections of guinea pigs at a stated time after inoculation with human and bovine strains of tubercle bacilli.

The derivatives proved to be fully potent, giving reactions in all cases where Old Tuberculin reacted, and in addition giving reactions in animals infected with bovine tuberculosis and reactions in the very early stages when tuberculin failed to produce a response. Of the three the ether-insoluble X proved the most potent preparation.

The transmission and treatment of infectious ophthalmia of cattle, F. S. JONES and R. B. LITTLE (*Jour. Expt. Med.*, 39 (1924), No. 6, pp. 803-810).—This is a report of further investigations of an acute inflammation of the eye of dairy cows, previously reported upon (*E. S. R.*, 50, p. 184).

Transmission experiments show that the bacterium will not remain viable for even a few minutes in the digestive tract of the house fly. Its life on the external surfaces of the fly is extremely short and in the authors' observations has not exceeded three hours, which strengthens the opinion that in the main the infection is not dust borne, since the bacterium soon dies when not in contact with the eye. It was found that the organism can exist in the eye throughout the winter, and with warm weather flies may transmit it to other susceptible individuals and thus the nucleus of an epidemic be established. The inflammation is said to subside readily when treated with 1-40 zinc sulphate solution.

The susceptibility of calves to contagious abortion when fed on milk from infected cows, J. QUINLAN (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 557-600).—Essentially noted from another source (E. S. R., 49, p. 680).

The question of the etiology of contagious abortion in mares [trans. title], E. ROMÁN (*Deut. Tierärztl. Wchnschr.*, 32 (1924), No. 37, pp. 546, 547).—The author reports that in a stud in which several abortions had occurred, both paratyphoid and colon bacilli were isolated from the aborted fetuses, and in some cases both organisms from a single fetus. The examination for agglutinins of the blood sera of 56 mares in the stud gave the following results:

In 20 cases agglutination took place only with the paratyphoid, in 4 only with the colon bacilli, in 30 with both organisms, and in 2 no agglutination took place. Following the vaccination of the animals with a paratyphoid auto-vaccine there were further abortions. In all these cases negative results were obtained with the paratyphoid and positive with the colon bacilli.

Preliminary notes on the life-history of *Oesophagostomum columbianum*, F. VEGLIA (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 809-824, pls. 2, figs. 6).—It is pointed out that the two most serious verminoses of sheep in South Africa are those occasioned by *Haemonchus contortus* Cob. and *O. columbianum* Curt., the life history (E. S. R., 35, p. 678) and chemotherapeutic treatment (E. S. R., 41, p. 873) of the former having been previously dealt with. The present paper deals with observations of *O. columbianum* made since 1920.

The author finds the postembryonic life of *O. columbianum* to be divided into four larval stages and the adult. The first two larval stages are passed in the open, while the third is commenced in the open and completed in the sheep, and the fourth and fifth stages are entirely parasitic.

"The parasitic life is passed wholly in the intestine of the host, and the larvae do not undertake migration through other organs. The normal locus of encysted larvae is the mucosa of the large intestine, but varying conditions of stomach digestion in the lamb may influence the rate of passage along the alimentary tract and displace the normal encysting points toward the small intestine. In cases of severe infection with mucous diarrhea many of the larvae may be passed out in the fluid feces and relatively few left behind.

"The minimum periods observed for parasitic development in young lambs may be provisionally indicated as follows: Second ecdysis completed in the first day after infection. On the second day the larvae penetrated the mucosa of the intestine and proceeded to encyst. On the fourth day they were generally found in lethargus undergoing the third metamorphosis. On the fifth day they were found in the active period of the fourth stage and engaged in completing the third ecdysis. On the sixth day larvae began to emerge from the cysts into the lumen of the large colon. By the twenty-sixth day a few larvae had already completed the fourth ecdysis, and by the thirtieth day most of the worms were found in the fifth or adult stage.

"The larval cyst appears to be the typical intestinal lesion necessary and sufficient for parasitic development. After emergence of the larva the cystic ulcer may cicatrize without leaving macroscopical traces. The caseous and calcareous nodules usually noted at post-mortem of infected sheep are apparently incidental sequelae, resulting from traumatic, necrotic, or bacterial complications, following original cystic ulceration."

Fowl cholera, J. J. BLACK (*New Jersey Stas., Hints to Poultrymen*, 12 (1924), No. 12, pp. 4, figs. 2).—A practical summary of information on this disease of poultry, probably the greatest in economic importance in New Jersey.

Note on an *Eimeria* n. sp. found in the faeces of an eland, M. J. TRIFFITT (*Jour. Trop. Med. and Hyg.* [London], 27 (1924), No. 16, pp. 223-225, pl. 1).—Under the name *E. canna*, the author describes a species new to science which was found in the feces of an eland, *Orias canna*, imported from Durban, Natal, into the zoological gardens in London. A list is given of 45 references to the literature.

Anthelmintic efficiency of carbon tetrachlorid in the treatment of foxes, K. B. HANSON and H. L. VAN VOLKENBERG (*Jour. Agr. Research* [U. S.], 28 (1924), No. 4, pp. 331-337).—Investigations conducted by the U. S. D. A. Bureau of Biological Survey indicate that many foxes, both in the wild and on ranches, are infested with hookworms, principally *Uncinaria stenocephala* and occasionally *Ancylostoma caninum*. While many foxes harboring hookworms manifest no apparent symptoms of infestation, the observations made indicate that heavy infestations may be attended with impaired health and may even result in death. The finding by Hall that carbon tetrachloride is effective for removing hookworms from dogs (*E. S. R.*, 45, p. 286) led to the experiments with foxes here reported in detail.

It was found that carbon tetrachloride in doses of 0.2 cc. or more per kilogram is very effective in the removal of hookworms and ascarids from foxes, and with a dose of 0.25 cc. or more per kilogram the drug was 100 per cent efficient against intestinal flukes. It proved about as effective in soft elastic globules as in hard gelatin capsules when feed and water were not given until three hours after the treatment. The authors find that, while many foxes will tolerate very large doses of carbon tetrachloride, it is not advisable to use doses in excess of 0.3 cc. per kilogram, and one-month-old fox pups do not tolerate it alone at that strength. Like most anthelmintics, it should be used with caution on sick animals. The use of a satisfactory purgative, such as a saturated solution of Epsom salts, is advised in conjunction with the administration of carbon tetrachloride to foxes.

RURAL ENGINEERING

A survey of reclamation (*Engin. News-Rec. Reprints*, 1923, pp. 64, figs. 9).—This survey contains articles on Origin, Problems, and Achievements of Federal Land Reclamation, by F. H. Newell; The Development of the West Under Irrigation, by C. E. Grunsky; Agriculture on Irrigated Lands, by C. S. Scofield; Twenty Years of Reclamation, by F. H. Newell; After Reclamation, Organized Land Settlement, by G. C. Kreutzer; Difficulties and Complaints of the Farmer, by H. H. Brook; Financial Troubles of the Reclamation Farmer and How They May Be Relieved, by J. T. Whitehead; Faults of Reclamation Law and Practice and Their Remedies, by T. H. Means; and The Future of Federal Reclamation, by A. T. Smith. These have been reprinted from numbers of the *Engineering News-Record* issued during the period from October 25 to December 20, 1923.

Development of irrigation projects (*U. S. Senate*, 68. Cong., 1. Sess., Com. Irrig. and Reclam., Hearing on Development of Irrigation Projects [etc.], 1924, pp. 11+55).—The text of the hearing before the Committee on Irrigation and Reclamation of the U. S. Senate on the development of irrigation projects and the deferring of payments of reclamation charges is presented.

Hydro-electric power in Washington.—Part I, A reconnaissance survey, C. E. MAGNUSSON (*Wash. [State.] Univ., Engin. Expt. Sta. Bul.* 26 (1924), pp. 52, pls. 9, figs. 9).—The results of a reconnaissance survey of the hydroelectric power of the State of Washington are presented and discussed.

The data indicate that the developed hydroelectric power in the State of Washington amounts to 454,337 h. p. It is also noted that 94 per cent of the electric power in Washington is produced by water.

Electrical service for rural districts as provided by the Hydro-Electric Power Commission of Ontario, F. A. GABY (*Engin. Jour. [Canada]*, 7 (1924), No. 7, pp. 458-472, figs. 19).—A description is given of the special features of the application of electrical energy to agricultural areas in the Province of Ontario, Canada, under the provisions of the provincial Hydro-Electric Power Commission. Data on rates, costs of rural distribution lines, and on power required for different types of farming and individual operations therein are included.

The estimation of rates is based upon a rural service classification containing eight different classes. These include hamlet service; house lighting exclusively and house lighting including power installations for miscellaneous small equipment not exceeding 2 h. p.; light farm service not exceeding 3 h. p.; medium single phase farm service up to 5 h. p.; medium three phase farm service up to 5 h. p.; heavy farm service up to 5 h. p., including an electric range, or 10 h. p. without the range; special farm service up to 20 h. p.; and syndicate service. Data on the estimated cost of electric power for each rural consumer on a 25-cycle system are given which are based on power at 5 cts. per kilowatt hour for the first 14 hours' use per month and 2 cts. per kilowatt hour for all remaining use.

The text of the legislation of the Province covering the supplying of electrical service to rural consumers is appended.

The Italian hydroelectric industry, L. DOMINIAN (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul.* 238 (1924), pp. II+17).—Data on the extent of the use of electricity in the varying districts of Italy, together with specific information on many of the important hydroelectric power systems of the country, are presented. It is stated that Italy now produces from 4,000,000,000 to 5,000,000,000 kw. hours of electricity annually, and it is estimated that the use of water to generate electric power represents a saving of about 3,000,000,000 lire (about \$579,000,000) in the Italian trade balance.

Steel and timber structures, edited by G. A. HOOL and W. S. KINNE (*New York and London: McGraw-Hill Co., Inc., 1924, pp. XVI+695, pls. 12, figs. 539*).—This book deals with the design and construction of steel and timber structures. It contains sections on buildings, roof trusses, short span steel bridges, timber bridges and trestles, steel tanks, chimneys, structural steel detailing, fabrication of structural steel, steel erection, estimating steel work, and materials.

Cinder block efficiency in pier tests (*Concrete [Detroit]*, 25 (1924), No. 1, pp. 35, 36, figs. 3).—Tests of cinder concrete blocks in piers at Columbia University are reported. The results showed that the ultimate strength in compression of these piers varied from 649 to 719 lbs. per square inch.

The results of compression tests on individual blocks similar to those used in the experimental piers gave ultimate net strengths varying from 1,305 to 2,080 lbs. per square inch. The ratios of the compressive strengths of the masonry piers to those of the individual blocks based on gross cross sectional area varied from 0.547 to 0.758.

Public Roads, [August-October, 1924] (*U. S. Dept. Agr., Public Roads*, 5 (1924), Nos. 6, pp. 25, figs. 30; 7, pp. 26, figs. 17; 8, pp. 24, figs. 9).—These numbers of this periodical contain the usual data on road material tests and inspection news and status of Federal-aid highway construction as of July 31, August 31, and September 30, 1924, respectively, together with the articles following:

No. 6.—Traffic Control and Safety, by E. W. James; Practical Field Tests for Subgrade Soils, by A. C. Rose; The Regulation of Motor Vehicles as Common Carriers, by H. R. Trumbower; Transportation of Hogs by Motor Truck, by E. L. Browne; and Highway Transportation Surveys Under Way in Cook County, Illinois, and Maine.

No. 7.—Motor Vehicle Fees and Gasoline Taxes, by H. R. Trumbower; Impact Tests on Highway Bridges; The Effect of Haul on the Cost of Earthwork, by J. L. Harrison (see p. 185); Rhythmic Corrugations in Gravel Roads, by G. E. Ladd; Oiled Earth Roads on Long Island, by A. T. Goldbeck; and Mid-year Motor Vehicle Registration 15,552,077, by G. G. Clark.

No. 8.—Reinforcing and the Subgrade as Factors in the Design of Concrete Pavements, by J. T. Pauls (see below); The Cost of Grading with Fresnoes, by J. L. Harrison; Sand-clay and Semi-gravel Roads Studied; and Causes of Nonuniformity of Concrete.

Reinforcing and the subgrade as factors in the design of concrete pavements, J. T. PAULS (*U. S. Dept. Agr., Public Roads, 5 (1924), No. 8, pp. 1-9, figs. 5*).—Two and a half years' service studies of an experimental road on the relation between the cracking of concrete roads and the character of the subgrade and steel reinforcing are reported.

The results showed that subgrade materials with a large percentage of clay not only attain a high moisture content during the wet season but also during the dry season, and that subgrades having a large percentage of sand do not attain a high moisture content but have a high capillarity. Subgrades composed largely of clay swell and contract as moisture is added or taken away. The conclusion is drawn that subgrades that show as much as a 10 per cent change in volume by laboratory tests should be covered with a layer of coarse granular material, and a pavement laid on a subgrade of this character should have a longitudinal joint at the center.

It was found that plain concrete slabs will crack transversely because of temperature and moisture changes at intervals of from 40 to 60 ft. Smooth subgrade surfaces increase the distances between cracks, but the thickness of the concrete does not affect the spacing of the contraction cracks.

Pavements reinforced longitudinally will develop transverse contraction cracks, the number, spacing, and size of which are controlled by a number of factors. If the steel reinforcing is not continuous but is separated by joints, it is to be expected that no cracks will form less than 30 ft. from any joint, and by a suitable relation of the percentage of steel to the length over which the steel is made continuous the distance may be increased to 60 ft. If the spacing of the joints is less than twice the distance in which a crack would form, contraction cracking may be entirely prevented. With a high percentage of continuous steel, relatively fine, closely spaced cracks may be looked for; with a low percentage, breaks in the steel may be expected to permit wider cracks to form at considerable intervals. Mesh reinforcing was found to be likely to break at intervals and permit cracking.

Attention is drawn to the possible danger of the use of too high a percentage of longitudinal steel, since under such conditions numerous fine transverse cracks will develop, making it possible that the narrow transverse beams thus formed will crack under traffic.

It was further found that the practice of omitting contraction joints in pavements reinforced longitudinally is questionable. Apparently the design should provide for contraction joints from 50 to 100 ft. apart. The results as a whole are taken to indicate conclusively the great importance of subgrade investigations in connection with the design of pavements.

The effect of haul on the cost of earthwork, J. L. HARRISON (*U. S. Dept. Agr., Public Roads, 5 (1924), No. 7, pp. 14-17, figs. 4*)—The results of studies are summarized indicating that there is no means of handling earth which eliminates the factor of distance moved as a dominant element in cost. It was found that at certain hauls a wheeler will move earth more cheaply than a fresno, and for the longer hauls (over 300 ft.) it appears probable that the elevator grader moves earth somewhat more cheaply than either of the other forms of equipment. However, no form of equipment has been found in common use which enables contractors to disregard distance as a primary consideration in the cost of moving subgrade materials.

Car carburetion requirements, C. S. KEGERREIS and O. CHENOWETH (*Purdue Univ., Engin. Expt. Sta. Bul. 17 (1924), pp. 20, figs. 8*).—Studies are reported which showed that engines in good mechanical condition have the same mixture requirements which vary with load but not with speed. At all fractional loads, maximum economy is reached at the lean limit of inflammability, which is not changed by engine speed.

Acceleration, representing the available reserve power, is a high load condition and requires a high power mixture. Manifolding to secure adequate vaporization and correct distribution is therefore a prerequisite to correct carburetion.

The demands of an automotive vehicle on its engine are determined by weight, gear ratio, wheel diameter, tire characteristics, road or soil conditions, and frictional resistance. These, in conjunction with the size of the engine, therefore establish the demands on the carburetor.

Vehicles of the same weight may require the same mixture ratios of fuel and air but differing gear ratios, and other factors will make the flow rates different at the same speed. Thus, each vehicle may have its individual level road mixture requirements even if the engine requirements are common. Operation on smooth level road requires richer mixtures than any other running conditions except idling, acceleration, and wide open throttle. Therefore, a carburetor designed to meet these conditions will give the greatest practical economy.

It is pointed out that in the ideal carburetor engine load should be recognized in addition to rate of air flow. A positive enrichment for acceleration and for open throttle running is essential. The most a carburetor can do for a vehicle is to enable the engine to develop its inherent economy, and that without limiting its capacity, and to permit the engine to operate at its maximum thermal efficiency under any fractional load.

Air-filters, L. L. DOLLINGER (*Jour. Soc. Automotive Engin., 15 (1924), No. 1, pp. 66-68*).—Data on benefits derived from filtering air in internal combustion engines are briefly presented and discussed.

Recent observations of air-cleaning devices, C. P. GRIMES (*Jour. Soc. Automotive Engin., 15 (1924), No. 1, pp. 63-65, fig. 1*).—The author summarizes his experiences and conclusions covering the past three years, including data on 16,000 cleaners produced in the past two years. Attention is drawn to the common practice of combining the oil filter and oil breather on the crankcase.

The crankcase breather is often an enlarged passage with an oil screen permanently mounted near the entrance. This passage and the screen must be open to dusty air for breathing. They are always moist with oil vapor which catches all dust particles passing nearby and form an excellent dust filter which should be cleaned often. The prevailing practice, however, is to wash all grit and dirt out of this passage into the crankcase when filling with fresh oil.

Testing of air-cleaners, A. B. SQUYER (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 1, pp. 33-37, figs. 5).—Studies of methods of testing air cleaners are reported.

It is stated that the three essential requirements of air cleaners are maximum cleaning efficiency, minimum attention from the operator, and minimum power loss. Among other methods of testing, an attempt was made to use a dry centrifugal cleaner of predetermined efficiency in series with the cleaner under test to catch a portion of the dust escaping. It was found, however, that the efficiency of the centrifugal cleaner varied with the fineness of the dust, and that the dust escaping another cleaner was so fine that almost none of it was caught by the centrifugal cleaner.

It was discovered that soft felt $\frac{3}{8}$ in. or more thick was 100 per cent efficient when used as a filter. A filter was therefore arranged using soft felt $\frac{5}{8}$ in. thick interposed in the air line from the cleaner under test to the carburetor. The filter was arranged so that the felt could be removed and weighed. In making a test, the apparatus was set up using an air jet for suction instead of an engine. A Venturi meter was inserted in the line to assure correct air velocity. The apparatus was operated without feeding dust until the weight of the felt became constant. Then 50 gm. of dust was fed into the cleaner and from the increase in weight of the felt filter the efficiency of the cleaner was computed. The best cleaners, as determined by this method, were then checked by the use of an engine under load on a Sprague cradle dynamometer.

The mechanism of lubrication.—III, The effect of oiliness on the behavior of journal bearings, D. P. BARNARD, H. M. MYERS, and H. O. FORREST (*Indus. and Engin. Chem.*, 16 (1924), No. 4, pp. 347-350, figs. 8).—In a further contribution from the Massachusetts Institute of Technology (E. S. R., 47, p. 890), the results of a series of experiments to determine the effect of oiliness of the lubricant on the carrying power of a conventional type of journal bearing are reported.

It is shown that the carrying power is somewhat greater when oiliness, as measured by the coefficient of static friction, is increased. This increase is small for variations among commercially practicable lubricants.

The position of the transition point from stable to unstable lubrication for a complete cylindrical bearing was found to be altered by variations in the oiliness of the lubricant. The transition point occurs at a lower value of the modulus zn/p when oiliness as indicated by the coefficient of static friction is increased. In this modulus z is the viscosity of the lubricant, n is the speed of rotation of the journal, and p is the nominal pressure on the bearing in pounds per square inch.

The variation of the transition point from stable to unstable lubrication to be expected with commercial lubricants was found to be not over 10 per cent. While it is possible to detect changes in oiliness by means of a journal testing machine, the experimental difficulties are considered to be such as to preclude the use of such a machine for the measurement of this property. It is believed that the coefficient of static friction offers the most convenient single measurement of oiliness.

It was further found that the position of the transition point is strongly affected by variations in clearance.

Water in crankcase oils, A. L. CLAYDEN (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 1, pp. 47-50, figs. 3).—The three ways in which water may reach the oil pan of an internal-combustion engine are described, and it is stated that the danger point for water accumulation is reached where an emulsion becomes

too highly viscous or when an accumulation of free water reaches the pump intake.

An emulsion of oil with water up to 5 or 6 per cent was found to differ hardly at all from the pure oil so far as film forming and lubricating qualities were concerned. On the other hand, with an oil that was absolutely non-emulsifying the tendency was for the water to segregate and collect in comparatively large globules. The ability of an oil to absorb a small percentage of water had the advantage of minimizing the danger of complete failure of oil circulation when starting in cold weather and of reducing somewhat the rate of piston ring and cylinder wall wear.

Further experiments showed that the rate of deposition of water in the cylinder oil may be indicated by a straight line graph between 35 and 110° F., the deposition ceasing at the latter temperature. When continued below 35° in the same straight line, the graph shows that at 0° the rate of deposition would be 80 cc. per hour.

Factors affecting the rate of crankcase-oil dilution, J. O. EISINGER (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 1, pp. 69-74, figs. 11).—Studies are reported which showed that the temperature of the jacket water of the internal-combustion engine has a marked influence upon the rate of dilution. This does not appear to be due to the change in the viscosity of the oil upon the cylinder walls or to a change in the piston head temperature, but rather to the differences in the rate at which the diluent is added to or eliminated from the oil film. It is shown that under certain circumstances the diluent is eliminated at a fairly rapid rate, and hence that an equilibrium condition may be reached at which the rate of elimination balances the rate at which the diluent is added.

A possible solution of the crankcase-oil dilution problem, I. L. ANDERSON (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 1, pp. 43-46, figs. 6).—A brief discussion is given of the method of ventilating the crankcase as a solution of the crankcase oil dilution problem. The apparatus used is described, and tests under operating conditions are reported.

Much less oil dilution occurred when the crankcase was ventilated, and the gasoline consumption was less. However, more oil was consumed.

Further tests indicated that a large percentage of the extra oil consumption was caused by oil in the form of a fine spray being carried with the air into the carburetor. This oil was caught by the oil trap, utilizing centrifugal force, and was found to be of good quality. Quantitative values seemed to indicate that only part of the oil carried by the air into the explosion chamber was burned, the remaining part serving as a lubricant in the cylinder.

This method of solving the crankcase oil dilution problem requires only an inexpensive apparatus and operates with negligible power.

Rectification of diluted crankcase-oil, R. L. SKINNER (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 1, pp. 51-59, figs. 9).—The engineering development of a rectifying device and system designed to combat the problem of diluted crankcase oil is briefly outlined.

In this system diluted oil is drawn from the cylinder walls and pistons by vacuum and conducted into a still where it is subjected to heat from the engine exhaust. The heating action is just sufficient to volatilize the fuel and water, the resulting vapor being returned to the intake manifold and thence to the engine where it is burned. The lubricating oil that remains behind is conducted back into the crankcase.

Comparative tests to determine engine wear with and without the device are described. In one of these dust was intentionally introduced into the

intake manifold. It was found that an ordinary amount of dust is not harmful if the oil is maintained at somewhere near its initial viscosity by a rectifying device. Data on relative wear are presented graphically.

Practical hog houses for Indiana, C. A. NORMAN and J. W. SCHWAB (*Purdue Agr. Ext. Bul.* 76, 2. rev. ed. (1924), pp. 8, figs. 12).—Information, drawings, and bills of material for hog houses adapted to Indiana conditions are presented.

The Ohio individual farrowing house, J. W. WUICHET and H. P. TWITCHELL (*Ohio Agr. Col. Ext. Bul.*, 19 (1923-24), No. 9, pp. 4, figs. 2).—Information, drawings, and a bill of material for the construction of a farrowing house adapted to hog raising conditions in Ohio are presented.

Investigation of pollution of streams (*Albany: N. Y. Conserv. Comm.*, 1923, pp. 50, figs. 10).—This report contains the results of a survey of the pollution of streams in the State of New York to date and suggests a form of administration for the further conduct of similar work, together with certain standards of allowable pollution. The survey has shown that streams in the State of New York are generally polluted in the more settled regions and are, in fact, free from pollution only in the most remote portions of the Adirondacks. This pollution is general and is increasing. It is serious now only in the neighborhood of the larger cities where wastes from a small city are discharged into an unusually small stream and below certain types of factory such as paper mills.

The polluting waste of greatest volume is sanitary sewage. Second in importance are wastes from the milk industry.

More actual damage to fish is caused by intermittent than by continuous pollution, but a material amount of such pollution results from accident.

A bacteriological study of a sewage disposal plant, W. H. GAUB, JR. (*New Jersey Stas. Bul.* 394 (1924), pp. 24, figs. 4).—Studies on the nature and work of the bacteria and their relative numbers as found in the effluents of the various units in a sewage disposal plant are reported.

The results showed that there is a continual decrease in the number of bacteria in the plant used, which consisted of Imhoff tanks, sludge drying beds, and trickling filter beds. The average final percentage of reduction throughout the four seasons of the year was 95 per cent at 37.5° C. and 94.3 per cent at 20°. The effluent from the plant caused an increase in the number of bacteria in the stream in which it empties, but this increase was entirely eliminated in a distance of 450 ft.

The intestinal bacteria were found to predominate throughout the plant, there being a gradual increase in the percentage of intestinal bacteria in all units preceding the sprinkling filter beds. A decrease in the percentage of these bacteria was found in the sprinkling filter beds and in the remainder of the units of the plant.

Sulfur-oxidizing bacteria were found in greatest numbers in the effluents of the sprinkling filter beds and final settling tank. Sulfate-reducing bacteria were found in the raw sewage and in the effluents of all units, the greatest number being in the raw sewage. Proteolytic bacteria, both gelatin-liquefying and casein-digesting, were found in the effluents of all units. In the final settling tank only the gelatin-liquefying type of proteolytic bacteria was found. The effluent from the Imhoff tanks contained the greatest number of these proteolytic bacteria. Cellulose-decomposing bacteria were found only in the concentrated sewage effluent of the Imhoff tanks and sprinkling filter beds. Ammonifying bacteria were found in the effluent of all units, while nitrifying bacteria occurred in great numbers only in the effluent of the sprinkling filter

beds. The latter were present in the Imhoff tanks after a long incubation period and in much smaller numbers.

Intestinal aerobic and anaerobic bacteria were the predominating types occurring in the sludge. The nitrifying type was found in the sprinkling filter beds, but none occurred in the raw sewage or in the effluent from the Reinsch-Wurl screen. The effluent from the Imhoff tanks contained only a relatively few nitrifying bacteria, and that from the sprinkling filter beds and from the final settling tank contained them in the greatest numbers. The relative stability of the effluents of the various units was found to increase with the successive units in the process of treatment.

RURAL ECONOMICS AND SOCIOLOGY

The relation between rents and agricultural land values in theory and in practice, F. A. BUECHEL (*Texas Sta. Bul. 318 (1924), pp. 4-71, figs. 12*).—It is intended here to show some of the basic facts that influence land values and to point out the relationship that exists between rent and land values. The latter are held to be the summation of all future rents discounted at a rate of interest that reflects the preference for the present over the future. Formulas for the capitalization of rent presented by Taylor (*E. S. R.*, 42, p. 789) are quoted. Besides future rents and interest rates, the influencing factors include the farm as a home, community development, personal preference, high-power salesmanship, credit facilities, and taxation.

A statistical study was made in order to determine the relation of rents to land values in Brazos, Williamson, and Dallas Counties, Tex., and the data are compared with others obtained in similar studies in certain typical agricultural States. Share rent was found to be the dominant type in the counties studied, cash rent being met with but rarely, and the calculations were made on the basis of the third and fourth share. Census data, statistics from the yearbooks of the Department of Agriculture, and samples of land sales from 1910 to 1920 were used, and from these data as a basis the desired estimates were derived. The analysis seemed to show that the ratio of share rent to land values falls when there is a drop in price or a poor crop and conversely, and when there is a tendency for the share rental to rise for a series of years land values very soon rise and the ratio of rents to land values diminishes even though the value of the share rent continues to rise. The lowest rate of return is to be found on the best land for the reasons that on this land the tendency has been for rents to rise most rapidly, and that as a result of this tendency the landlord has capitalized the future increases as well as the rent. It is held that appraisers of land appear to be influenced too much by the prevailing land prices. Tables with graphic illustrations present the data in detail.

Some economic and social aspects of Philippine rice tenancies, E. D. HESTER ET AL. (*Philippine Agr.*, 12 (1924), No. 9, pp. 367-444, figs. 6).—A number of hitherto unpublished theses and papers in rural economics are combined in this contribution. A review of the history of Spanish land tenure in the Philippines is followed by an account of eight surveys carried on during 1921 and 1922 in districts where rice was produced under share tenancy agreements. Taken together these surveys represent a gross area of 1,975.2 hectares (about 4,880 acres), gross area being taken to mean the area of the holding regardless of its culture or cropping system. The average gross area of the rice tenancies surveyed was 2.4 hectares, of which 99.7 per cent was cultivated. Of the effective area, 91.8 per cent was planted to rice, other crops

being corn, sugar, zacate, and vegetables and fruits. The average length of tenure was 6.8 years. Of six surveys reporting in this respect, 18 per cent of tenants were operating under more than one landlord. A typical contract is outlined, and certain exceptions to the rule are noted. In only two instances was a written instrument between landlord and tenant discovered.

The average labor time was 299 hours per hectare per year, which is excessively small as compared with available data from China and Japan. The labor distribution among processes was 39 per cent to the preparation of the land, 7 to planting and transplanting, 13 to cultivation, 30 to harvesting, and 11 to general labor. For every hour of human labor there was approximately one-half hour of animal labor, the carabao being used chiefly.

The tenant was generally responsible for all capital goods and was found to have on the average an investment of ₱143 (\$71.50) per hectare, divided in the proportion of 35 per cent in dwellings and yards, 1 in farm buildings, 8 in implements and vehicles, and 56 in work animals.

The average tenant's share of the farm income was ₱80 per hectare per annum. After deducting interest on investment at 8 per cent and depreciation at 12 per cent, the income left the tenant and his family an hour wage of 17 centavos (8.5 cts.) as against the current wage for agricultural laborers of 8 centavos and for municipal school teachers and master carpenters of 38 and 36 centavos, respectively.

The fact that it would take 163 years for the average tenant to acquire ownership of land equal to his small present holding leaves little ground for encouragement of tenancy as a step toward ownership in the Philippines.

Numerous related social data are included in this report. An extensive bibliography is given.

Input as related to output in farm organization and cost-of-production studies, H. R. TOLLEY, J. D. BLACK, and M. J. B. EZEKIEL (*U. S. Dept. Agr. Bul.* 1277 (1924), pp. 44, figs. 16).—The method of study presented in this bulletin begins with a detailed analysis of the variations in methods and practices (input variations) and the effect of these variations upon the product (output per unit of input). The basic data thus obtained are then used to determine the least-cost combination of inputs by applying value rates to the inputs and outputs at various combinations of the input factors. The least-cost combination is that combination which will produce the product at the least cost per unit of output. Considering the value of the product per unit and the volume of production at various combinations of the input factors, it is possible to estimate the total profit from the enterprise for different input combinations and thus to determine the most profitable combination of input factors. The discussion of combination of enterprises points out the difficulties in the way of thus determining the best organization without attempting to solve the problem completely.

This discussion of method is illustrated by data found in various farm organization and cost of production studies. Analyses are made of variations in the value of fertilizer applied per acre of potatoes and the correlation between this and the average input of other factors per acre. Further examples are found in the feed inputs for beef cattle and the labor inputs for wheat. In order to show statistically and graphically what output accompanies a given input of each of the elements of input, further data on potatoes, beef, and wheat production are used. The applications of the method for determining the least-cost combinations of inputs, the most profitable combinations of inputs, and the proper combination and proportion of enterprises are set forth. Further applications briefly suggested are its use in supplying individual producers with production standards, a basis of choice of farm practices,

and an aid in planning the farm business and its use in arriving at index numbers for the costs of various farm products and also in forecasting the supply which will be forthcoming at any given price. Statistical methods mainly in the way of multiple, curvilinear, and multiple curvilinear correlations are explained.

Wheat and wheat products, T. O. MARVIN ET AL. (*Washington: U. S. Tariff Comm.*, 1924, pp. III+71, figs. 4).—A report is submitted by the U. S. Tariff Commission to the President of the United States with regard to an investigation of the differences in costs of production of wheat and wheat products in the United States and Canada. A reservation with reference to mill feeds is made by Marvin, and two statements are included setting forth the views of the commissioners as to the application of the data to the rates of duty, together with an appendix containing the President's proclamation.

A summary is presented of data representing 1,832 farm cost records in 79 localities in Minnesota, North and South Dakota, and Montana, and in the Provinces of Manitoba, Saskatchewan, and Alberta in Canada. Flour milling costs were likewise obtained from 6 companies in Canada and 21 in the United States, representing 93 and 60 per cent of the total hard spring wheat flour production, respectively. The weighted average cost of production of wheat in the United States was 52 cts. in excess of that in Canada for the crop of 1923, with a land charge on the cash rental basis. The 3-year average cost for 1921 to 1923, inclusive, with land charge on a cash rental basis, showed an excess of 33 cts. for the United States over Canada.

The total average charge in the hard spring wheat States for carrying wheat from the farmer's wagon to the door of the Buffalo elevator was 35.07 cts. In western provinces, allowing for differences in exchange, the average charge was 26.23 cts. per bushel. The difference in favor of the Canadian wheat grower was 8.84 cts. per bushel, of which 2.50 cts. was derived from a lower average cost of handling through the country elevator, 5.33 cts. from the lower rail rates to the head of the lakes, and 0.55 ct. from lower terminal charges.

The commission submits certain facts regarding the competition between domestic and Canadian hard spring wheat. It is said that at the present time the import duty of 30 cts. a bushel appears to be almost if not completely effective in raising the price of the domestic wheat over the Canadian level. It is shown that the United States farmers received on the average 12 cts. a bushel more than the Canadian, and if marketing and transportation charges had been equal they would have received 21 cts. more. It is regarded as not certain, however, that a tariff duty of 40 or 45 cts. a bushel would raise the American price by that amount over the Canadian level.

It appears that the cost of producing and marketing hard spring wheat flour, not including the cost of wheat ground, is 57.77 cts. per 100 lbs. in the United States and 50.09 cts. per 100 lbs. in Canada.

Housing of casual labour, E. H. PRATT (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1924), No. 11, pp. 1017-1023).—The accommodation of seasonal fruit pickers in the raspberry-growing districts of Perthshire, Scotland, is set forth here.

Report on agricultural credit, H. M. TORY (*Ottawa: [Dept. Finance]*, 1924, pp. 90).—Facts gathered in the study of rural credits are presented in this document in six sections, each complete in itself, dealing with general considerations; rural credit in Europe, in the British Empire outside of Canada, in the United States, and in Canada; and methods in relation to Canadian conditions.

It is pointed out that in Canada organized long-term credit is a private enterprise in the hands of the mortgage companies and insurance companies

and short-term credit is in the hands of the banks. No effort has been made to meet intermediate credit needs except by the banks. The efforts of the individual provinces to organize these forms of credit are discussed.

It is said that especially in western Canada the mortgage business is conducted in an expensive manner, and that reasonable cooperation between loan companies might greatly reduce the present cost of administration. Further, some plan of amortization of loans is deemed necessary for a considerable number of farmers in Canada. It is held that the establishment of a short-term credit system based on the formation of local associations for cooperative purposes would be difficult on account of the lack of uniformity in the population and permanence, but that a sound plan along European lines could be worked out under proper supervision and control. Further intensive study of the problem is recommended.

[**Reports of the Land and Agricultural Bank of South Africa, 1922 and 1923**], T. B. HEROLD ET AL. (*Union So. Africa, Land and Agr. Bank So. Africa, Rpts. 1922, pp. 35; 1923, pp. 40*).—Reports are continued for the later years along lines previously noted (E. S. R., 47, p. 894).

The single-tax complex of some contemporary economists, H. G. BROWN (*Jour. Polit. Econ.*, 32 (1924), No. 2, pp. 164-190).—A brief review is made of the opinions of professional economists on the single tax, meeting their arguments that a single tax is a deterrent to thrift, that it was tried in France under the Physiocrats and abandoned, and that additional taxation of land values would violate the principle of good faith in property owning. It is held that a higher tax on land values would make a lower selling price and that other taxes could be correspondingly reduced. Certain economists are thought to oppose increased general taxation of land values as infringing on vested rights, and simultaneously to favor special taxation of future land value increments as not infringing on such rights.

Crops and Markets, [September, 1924] (*U. S. Dept. Agr., Crops and Markets*, 2 (1924), Nos. 10, pp. 145-160; 11, pp. 161-176; 12, pp. 177-192, fig. 1; 13, pp. 193-208).—The usual weekly abstracts and reviews of market reports are presented, together with tabulated data showing the receipts and prices of important agricultural commodities at the principal markets and notes on foreign crops and markets.

Co-operative livestock marketing in the United States (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1924), No. 12, pp. 1094-1098).—In this brief review the progress of livestock producers in the development of cooperative agencies, particularly since the war, is emphasized.

Co-operative marketing of milk in the United States (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1924), No. 11, pp. 1007-1012).—Four examples of cooperative milk marketing organizations in the United States are briefly described. Three are characterized as primarily bargaining associations which fix prices by meeting the distributors and attempting an agreement. Their ultimate weapon during the early years was the strike. The fourth is said to be a more advanced development on cooperative lines.

Cooperative marketing and city marketing problems (*Natl. Assoc. State Marketing Off. Proc.*, 5 (1923), pp. 70, pl. 1).—These pages embody the proceedings of the National Association of State Marketing Officials in its meeting in December, 1923. Reports of committees on matters connected with the marketing of agricultural products were heard, together with the following addresses: Opening address, by F. B. Bomberger; Development and Growth of Cooperative Marketing in the United States, by L. S. Tenny; Some Fundamentals of Cooperative Marketing, by E. G. Nourse; Forms and Business Management of Cooperative Associations, by W. Peteet; Cooperative Marketing

of Live Stock, by I. C. Grimes; Position of the Federal Bureau in Regard to Cooperative Marketing, by H. C. Taylor; Recent Developments in Marketing, by L. D. H. Weld; Some Results of Terminal Market Studies, by W. P. Hedden; and The Detroit Public Markets, by G. V. Branch.

American agriculture and the European market, E. G. NOURSE (*New York and London: McGraw-Hill Book Co., Inc., 1924, pp. XVII+333, figs. 47*).—This study has been prepared with the aid of the council and staff of the Institute of Economics. It is an attempt to reveal the development and present position of American agriculture as affected by the growth and present status of European markets and the expansion and present position of competing producing areas. The effects of European development upon American agriculture prior to 1900, the changed conditions beginning near the end of the century, the effects of the World War upon our agriculture, the world-wide conditions contributing to the present depression in American farming, and the prospects of American exports to Europe in the immediate future are subjected to critical examination.

A marked decline in agricultural exports during a period of approximately 15 years prior to the outbreak of the European War is pointed out and attributed to the encouragement by European nations of greater self-sufficiency, the development of other sources of supply, and the growth of the American domestic market. It is held that American farmers can not afford to produce the present quantity of exports at the present level of costs for the low-priced European market, nor can European consumers afford to buy any great proportion of their agricultural supplies in our relatively high-priced market; therefore, we must return to the position of declining agricultural exports of 1914. Agricultural exports may be expected to drop still further in 1924 and thereafter.

Appendixes set forth statistical agricultural exports during the period of growth, 1870-1900; agricultural exports during the period of decline, 1900-1914; agricultural imports into the United States, 1870-1914; and Germany's foreign assets.

The possibilities of British agriculture, H. REW and E. J. RUSSELL (*London: John Murray, 1923, pp. 32*).—The authors discuss data derived from numerous recent inquiries into the question of the food requirements of the British nation and the extent to which they are at present supplied by home production. It is pointed out that a large margin exists between home production and home consumption, so that there is opportunity for the home farmer to find a market for meats, including poultry, and also for eggs, cheese, and butter. Means are suggested for the improvement of production along these lines in the way of better drainage, better cultivation, more effective use of artificial fertilizers, the introduction of improved varieties, better combinations of crops, and the control of plant diseases, and particularly by the development of specialization in farming.

The farmer's problem (*London: John Murray, 1923, pp. VIII+47*).—The author challenges the assumption that British agriculture is doomed, and urges a self-help policy of the utilization of modern methods of joint sales, transport, standardization, and purchase of supplies.

The foundations of Indian agriculture, H. M. LEAKE (*Cambridge, Eng.: W. Heffer & Sons, Ltd., 1923, 2 ed., pp. VIII+277, figs. 10*).—This is a reprint under a new title of a volume previously noted (*E. S. R.*, 45, p. 291).

Developing rural social work, L. A. RAMSDALL (*Country Life Bul.*, 2 (1924), No. 6, pp. 1-3).—The tentative program on rural social work adopted by the American Country Life Association at the Sixth Annual Country Life Conference, November 8-11, 1923, is published here.

Community organization for the country life program, W. BURE (Country Life Bul., 2 (1924), No. 6, pp. 4-8).—The rural organization committee of the American Country Life Association presents and interprets some conclusions by their correspondents with regard to successful rural organizations in various parts of the United States.

Organized co-operation, J. J. DILLON (New York: Rural New-Yorker, 1923, pp. 134).—This volume in three parts constitutes an account of the development of organization in connection with farming, a definition of the fundamental principles of cooperation and policies of organization, and some suggestions for the application of cooperation to efficient and economic distribution of farm products.

Monthly Supplement to Crops and Markets, [September, 1924] (U. S. Dept. Agr., Crops and Markets, 1 (1924), Sup. 9, pp. 289-320, figs. 4).—Current estimates of acreage and yields of the principal crops are offered with comparisons with earlier years and periods of years, and crop conditions, September 1, 1924; farm prices, the livestock and meat situation, and the receipts and disposition of livestock at important markets; cold storage holdings; shipments of fruits and vegetables; the market for and the prices of milk and milk products; grain receipts; and other data are tabulated. A report is given of a milch cow survey by the Department, which was carried out by the rural mail carriers in 1924 covering 121,000 farms. A review of the price situation is made with particular attention to wheat, corn and oats, hogs, and cotton.

The world's cotton crops, J. A. TODD (London: A. & C. Black, Ltd., 1923, pp. XV+460, pls. 42, figs. 6).—This is a reprint, with a few corrections, of an earlier volume (E. S. R., 33, p. 433).

Early estimates of grain growing in Great Britain (Jour. Min. Agr. [Gt. Brit.], 30 (1924), No. 11, pp. 1012-1016).—Some statistics of acreage and production of crops derived from reports prepared before 1866 are reproduced, and miscellaneous early sources of estimates are noted.

Annual agricultural statistics, 1921 [and 1922] [trans. title] (Statist. Agr. Ann. [France], 1921, pp. 245; 1922, pp. 164).—These annual statistical reports for France continue the series previously noted (E. S. R., 49, p. 296).

Report on crop yields in Norway, 1923 [trans. title] ([Norway] Landbr. Dir. Årsberet., Tillegg A, Beret. Høsten, 1923, pp. 64).—Yields per hectare and percentages of increase or decrease over former years are tabulated, and notes upon crop conditions are presented by districts.

Agricultural statistics of Siam, 1922 and 1923 (Siam Statist. Yearbooks, 7 (1922), pp. 247-267; 8 (1923), pp. 263-283).—Tabulations are again presented continuing data previously noted (E. S. R., 47, p. 493).

AGRICULTURAL EDUCATION

Teacher training in agriculture (Fed. Bd. Vocat. Ed. Bul. 94 (1924), pp. VI+79, figs. 4).—The material for this bulletin was prepared by H. M. Skidmore under the direction of C. H. Lane. The study deals with the status, development, and methods in the field of teacher training, supplementing earlier ones (E. S. R., 41, p. 298; 50, p. 795). It covers the main topics of organization and administration, curricula, physical equipment of teacher-training departments, improvement of teachers in service, teacher-training faculties, methods used in college teaching, and a brief historical background of teacher training.

Practically all of the teacher-training departments are found to be grouped in the three classes of those found in universities or colleges having schools or departments of education, those in agricultural colleges having no departments of education, and those in which a special school or department for the training of teachers is organized within the college of agriculture in an institution where there is also a school or department of education. The first type is held to have the very decided advantage of freedom of movement in the institution, the head being responsible directly to the president. The others also have certain points in their favor. The division of education is thought to be, theoretically, the place to prepare vocational teachers since it becomes the whole duty of this division to prepare teachers, while all other divisions are mainly engaged in the work of developing lines of technical subject matter.

The courses which have been uniformly recommended as covering the requirements for professional preparation in institutions where 15 to 20 units are required are introduction to teaching, secondary education, vocational education, teaching high-school agriculture, and supervised observation and directed teaching. An examination of many outlines of courses indicated that not enough attention is being paid to the preparation of teachers for the organization and teaching of part-time and evening work, the organization and supervision of students' practical work, farm shop and farm mechanics, and the function of the teacher in the community.

Two theories as to the best distribution of professional subjects in the curriculum are noted, one that the professional training should be superimposed upon the technical preparation and the other that these should be parallel. There is said to be substantial agreement among teacher trainers throughout the country that the work in special methods and supervised teaching should be placed as late in the curriculum as local conditions render possible, in any event not earlier than the second semester of the junior year.

Practice teaching arrangements are broadly grouped under the two heads of that type wherein a vocational department is organized in the local town or village high school under more or less complete control or direction of the teacher-training department of the institution, and the type wherein one or more rural vocational departments are developed for the most part under fairly complete control of the teacher-training department and fairly convenient to the teacher-training institution. A number of plans are described in detail, including the Ohio, Virginia, and Georgia plans and the apprentice system of practical teaching. Tables are presented which show semester hours devoted to and the frequency of occurrence of certain courses in education offered by the land-grant institutions and education courses required by land-grant colleges for the preparation of agricultural teachers. Five sample courses are outlined, and information with regard to organization for observation and directed teaching is tabulated.

Statistics of land-grant colleges: Year ended June 30, 1922, L. E. BLAUCH (*U. S. Bur. Ed. Bul. 6* (1924), pp.V+48).—Part 1 of this report presents a general discussion of Federal acts pertaining to land-grant colleges, educational surveys of land-grant colleges, histories, and other items. Part 2 presents detailed statistical tables made up from reports submitted by officers of the land-grant colleges.

The public school system of Arkansas.—Part I, Digest of general report, W. B. MANN ET AL. (*U. S. Bur. Ed. Bul. 10* (1923), pp. XVI+79).—The findings and recommendations of a survey made under the direction of the U. S. Commissioner of Education at the request of the Arkansas State Educa-

tional Commission are reported here. The field work was begun in November, 1921, and schools were visited in 50 of the 75 counties of the State.

With regard to the rural schools, it was found that the teachers were rather poorly prepared, the school term was inadequate, school attendance was irregular, and the enforcement of the compulsory attendance law was lax. A beginning has been made toward consolidating small schools in rural communities. Rural school buildings were found to be very unsatisfactory. The State has adopted a progressive method of selecting county supervisors.

It is held that more rural high schools are needed. The four district agricultural schools are said to be somewhat handicapped by the act of 1909 which established them. The survey recommends the inauguration of a State program of secondary education which will, in time, make other provisions for the service now rendered by these institutions, making possible their gradual release for other purposes. The development of a state-wide program of secondary education, including strong courses in agriculture, horticulture, and home making, is deemed possible through more adequate financial support, including State aid, and especially State stimulation and leadership, the adoption of the county unit plan of organization and administration, and the development of special courses relating to agriculture, home making, and rural life. A 10-year program is outlined.

Urban and village elementary and secondary schools and provisions for negro education are reported upon. The appendix gives an alternative plan for the future of the district agricultural schools.

[Home economics education and extension at the seventeenth annual meeting of the American Home Economics Association] (*Jour. Home Econ.*, 16 (1924), No. 9, pp. 479, 480, 500-502).—A suggestion for widening the influence of home demonstration work in home economics, presented by G. E. MacPhee to the home economics extension section of the annual meeting, is abstracted, and a round table discussion of extension work under the leadership of M. Butters is summarized. The report and program of work of the committee on home economics education for 1924-25 is reproduced as read by E. Conley, as is also that of the committee on home economics extension read by L. Reynolds.

The New World problems in political geography, I. BOWMAN (*London: George G. Harrap & Co., Ltd.*, 1924, [2. ed.], rev. and enl., pp. 630+[2]+112, figs. 303).—This is a revised and enlarged edition of a textbook previously noted (*E. S. R.*, 46, p. 697).

Elements of forestry, F. MOON and N. C. BROWN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1924, 2. ed., rev. and reset, pp. XVII+409, pl. 1, figs. 78).—A second edition is offered of a textbook previously noted (*E. S. R.*, 32, p. 692).

Judging Kansas live stock, C. G. ELLING (*Kans. Agr. Col. Ext. Bul.* 47 (1924), pp. 56, figs. 49).—The material compiled here is offered to meet the demands of club members of from 12 to 16 years of age and others interested in judging livestock.

Poultry raising for club members, D. H. HALL and J. H. NEELY (*Clemson Agr. Col. S. C., Ext. Bul.* 64 (1924), pp. 56, figs. 19).—This is designed as a guide for the boys and girls engaged in the first year activities of the Boys' and Girls' Poultry Clubs of South Carolina.

Twenty lessons on dairying for dairy club members, F. A. BUCHANAN (*Va. Agr. Col. Ext. Bul.* 72, rev. ed. (1924), pp. 94, figs. 12).—A manual for boys' and girls' clubs previously noted (*E. S. R.*, 48, p. 297) has been revised and enlarged.

Principles of veterinary science, F. B. HADLEY (*Philadelphia and London: W. B. Saunders Co., 1924, 2. ed., reset, pp. 550, pl. 1, figs. 123*).—A revision of a textbook previously noted (*E. S. R., 43, p. 76*) is offered.

The business of farming, C. ROBERTS (*Oklahoma City: Harlow Pub. Co., 1924, pp. [7]+385, pl. 1, figs. 159*).—The author designates this a manual of farm methods for Oklahoma. It is prepared with particular attention to the vocational point of view of farming as a business and is adapted to use in the public schools, as well as by the practical farmer.

Farm economics: Management and distribution, F. APP (*Philadelphia and London: J. B. Lippincott Co., 1924, pp. 700, figs. 248*).—This textbook, designed for high school classes in vocational agriculture and also college classes beginning the subject, covers the field of farm management as well as the subjects of marketing, prices of products, distribution, and economic questions relating to cost of production, farm balance, capital and credit, labor, crops, livestock, farm layout, purchasing, rental, accounting, cooperation, farm power, and equipment. Some graphic representations of statistics are made, and tabulated data are included in the appendix. Exercises are suggested by the author at the close of each chapter.

Home economics in education, I. BEVIER (*Philadelphia and London: J. B. Lippincott Co., 1924, pp. 226*).—This book considers the development of home economics in relation to the education of women and is intended for teachers of home economics, students, and others interested in the adjustment of education to modern needs. The general plan and arrangement includes three parts devoted to the evolution of educational ideals, the development of the education of women, and the development of home economics, respectively.

Textiles, W. H. DOOLEY (*Boston and London: D. C. Heath & Co., 1924, [4. ed.], rev. and enl., pp. XIII+750, pl. 1, figs. 123*).—This is a textbook designed to meet the needs of beginners in technical and textile schools of secondary grade. It includes the considerations of the artistic aspects of textile manufacture and methods of distribution.

Home accounts, G. LINN (*Iowa Agr. Col., Ext. Serv., Home Econ. Bul. 58 (1924), pp. 15, figs. 2*).—Some of the advantages of keeping accounts are set forth, and directions and suggestions are given.

NOTES

Kansas College and Station.—The college is asking for an appropriation of \$350,000 for a new library building. The library now contains 80,000 volumes and is valued at \$350,000.

The enrollment in the two 8-weeks agricultural short courses was notably higher than in 1924, with an increase in the farmers' short course of 10 per cent and in the commercial creamery short course of 100 per cent. A short course in cereal chemistry was held by the departments of milling industry and chemistry during the week of January 12. The program was devoted to discussions and laboratory exercises relating to recent discoveries in cereal chemistry. The 15 students who were in attendance came from the States of Kansas, Missouri, Texas, Nebraska, and Michigan.

Orders have been received from Argentina for 3,000 bu. of Kanred seed wheat and from Brazil for 33,000 bu. of the same variety. It is expected that the orders will be filled by the college and the Kansas Crop Improvement Association.

One of the farm journals published in the State has requested that the station supply for each issue one page of material on scientific discoveries of direct value to farmers. The request is based on the editor's belief that the intelligent use of science in farm practice offers one of the best opportunities to improve the farmer's economic position.

Claude K. Shedd has been appointed assistant professor of rural engineering in the division of extension, succeeding Mark Havenhill, resigned.

Kentucky University and Station.—A deed to approximately 400 acres of land near Princeton in Caldwell County has been received. This land has been donated by the citizens of that county for the use of the Western Kentucky Substation, authorized by the 1924 legislature with an annual appropriation of \$10,000. Operations were begun December 1, 1924.

C. H. Burrage has been appointed forester in the Robinson Substation at Quicksand in eastern Kentucky, authorized by the same legislature with an appropriation of \$25,000 per annum. This substation comprises about 15,000 acres of land, and much attention will be given to forestry investigations.

Maryland University.—The new \$125,000 dairy and refrigerating plant is in operation, giving students the opportunity to obtain vocational instruction in dairying on a commercial scale. Milk, cream, and ice cream are being served to the public, and butter and other milk products will be furnished as soon as the necessary machinery is installed. Ample space provision has been made for the passing tourist trade, which is expected to be a considerable factor as the new building faces the Washington-Baltimore Boulevard.

Massachusetts College.—During 1924 four important bequests were made to the college. Mention has already been made of the Crane bequest of \$25,000 (E. S. R., 50, p. 798). A like amount is expected to be realized from the estate of the late Porter L. Newton of Waltham. Under this bequest, the residue of his estate is to be used to found the Porter L. Newton Educational Fund, the income from which will be available as the trustees see fit for im-

proving the agricultural situation in the State by the awarding of scholarships to undergraduates.

The Massachusetts Society for the Promotion of Agriculture has contributed four scholarships totaling \$1,000 in value. These scholarships are to be available for students majoring in either agriculture or horticulture.

By far the largest bequest ever made the college is contained in the will of Miss Lotta Crabtree. Miss Crabtree, who was widely known as an actress a generation ago, divided the bulk of her estate of several million dollars among a wide range of philanthropic objects. The college is made residuary legatee for the purpose of establishing the Lotta Educational Fund, the following language being used in the will: "I believe it my duty to attempt to aid in some of the great social and economic questions of the times, and it is my belief that the best method to reduce the cost and expense of living and to promote a generally more prosperous and larger employment for the people lies in the intelligent and active promotion of agricultural pursuits."

The bequest authorizes the trustees to make loans without interest to such graduates of the college as desire to engage in farming of such sums of money as may be necessary for their proper establishment in their chosen pursuits. Provision is also made for assisting needy and meritorious students to complete their course in the college.

The estate has been variously estimated in value, but the college may receive as much as \$1,000,000. Press reports announce that the will is being contested.

An exchange professorship in horticulture was effected during the week of February 2, F. A. Waugh exchanging lectures with Albert Dickens of the Kansas College.

Missouri University and Station.—The degree of bachelor of science in home economics is to be added to those offered by the College of Agriculture. With the completion of the home economics building late this summer, the college will install special equipment which will greatly enlarge the scope of the instruction offered in home economics.

A. M. Burroughs, instructor in horticulture and assistant horticulturist, was killed in an automobile accident September 8, 1924. He was born May 12, 1898, and graduated from Cornell University in 1920, receiving the M. S. degree in 1922. He had been employed at Cornell University and the Marble Laboratories, Inc., going to Missouri in January, 1923.

A. E. Murneek has been appointed assistant professor of horticulture.

Nevada Station.—Studies of alkali poisoning of sheep, cattle, and horses in progress since midsummer under C. E. Fleming and M. R. Miller have shown that solutions of native alkaline salts of the degree of concentration common in desert water holes have poisonous properties. With experimental animals on good feed but supplied only with the alkali water, it was shown that scouring and loss of flesh take place immediately and that more serious consequences soon follow. The tests seem to indicate that most of the cases of alkali poisoning reported from time to time are due to the dissolved salts in the water holes and not to poisonous range plants.

Rutgers College and New Jersey Stations.—The new dairy and animal husbandry building, previously described (E. S. R., 48, p. 698), has been completed.

The College of Agriculture and the stations cooperated with the State department of agriculture in an exhibit at Trenton during agricultural week, January 13-16. Members of the staff participated prominently in the program of the various meetings.

Willard C. Thompson, chief of the department of poultry husbandry, has been given a two years' leave of absence, beginning November 1, 1924, to serve as temporary director of the National Poultry Institute of England. This

institute has recently been established "for the promotion of advanced courses in poultry husbandry and the pursuit of research." It is located at Harper Adams Agricultural College, Newport, Shropshire, where a 10-acre plant with 11,000 birds is already available. Funds aggregating £50,000 are available for the institute, which is under the joint jurisdiction of the Ministry of Agriculture and Fisheries and the college.

Pennsylvania College and Station.—D. L. Van Dine, assistant professor of entomology extension, has accepted an appointment as entomologist of the Tropical Plant Research Foundation with headquarters at Central Baragua, Camaguey Province, Cuba. C. D. Dahle, assistant professor of dairy husbandry and assistant dairy husbandman in the Minnesota University and Station, has been appointed associate professor of dairy manufactures in the college and associate in dairy manufactures in the station vice W. B. Combs, who has become professor of dairy husbandry and dairy husbandman at the University of Minnesota. Other appointments include Warren B. MacMillan as assistant in forestry, and Edwin H. Rohrbeck, R. P. Tittsler, and E. Grant Lantz as instructors in agricultural extension, bacteriology, and farm machinery, respectively.

Vermont Station.—Dr. Ezra Brainerd, for the past eight years associated with the station, died at his home in Middlebury, December 8, 1924, at the age of 80 years.

Doctor Brainerd was a graduate of Middlebury College, and after graduation served in that institution through the grades from tutor to president, holding the latter position for 23 years. Upon retirement he devoted his efforts to his study of the flora of Vermont, which had long been under way. In this work he was not content with merely listing the plants and making a herbarium, but was one of the first to study the problem of relationships, variations within a species, the possibility of natural hybridization, and the origin of species by means of hybridization. The final results of his studies are given in three bulletins published by the station, Bulletin 217 dealing with his work with *Rubus* and Bulletins 224 and 239 with *Viola*. His work was of a high order and has constituted an important contribution to knowledge.

Wisconsin University and Station.—According to a recent report of the State leader, the county agent system is becoming more firmly established in Wisconsin. There is now a total of 47 county agents, and definite provision has been made in 29 counties for the continuance of their work, while an additional county where work was dropped two years ago has voted to restore it. In three other cases where unfavorable action had been initiated appropriations have now been restored for the next two years.

Bulletin 242 of the station, entitled *Milk the Best Food*, has just been translated into Spanish by direction of the Secretary of Agriculture of the Republic of Mexico for distribution in that country.

Twelfth International Congress of Agriculture.—Arrangements are being made to hold this congress at Warsaw, Poland, from June 21 to 24. The congress will be organized into sections of rural economics, plant production, agricultural industries, and agricultural research and education. The topics to be taken up under agricultural research will include the organization of collective experiments of long duration and their importance for agriculture, the coordination of agricultural experimentation by means of an international understanding, the organization of zootechnical experimentation, and the unification of methods for the analysis of manures and seeds. The representatives in the United States of the International Commission which has the congress in charge are Drs. L. O. Howard and A. C. True of the U. S. Department of Agriculture.

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RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Atoms, J. PERRIN, trans. by D. L. HAMMICK (*London: Constable & Co., Ltd., 1923, 2 Eng. ed., rev., pp. XV+231, figs. 16*).—This is the authorized English translation of the eleventh French edition of this treatise on physical chemistry, which has been brought up to date for the purpose of the translation.

On the science of color, W. OSTWALD (*Farbkunde. Leipzig: S. Hirzel, 1923, pp. XV+313, pls. 4, figs. 39*).—This monograph, which is one of the series entitled *Chemie und Technik der Gegenwart*, edited by W. Roth, deals with the chemistry, physics, and psychology of color.

Color and chemical constitution, J. MARTINET and P. ALEXANDRE (*Couleur et Constitution Chimique. Paris: Libr. Octave Doin, 1924, pp. [3]+328*).—In the introductory section of this monograph, the meaning of the term "color" is discussed and illustrations are given of various types of unsaturated groups upon which color is considered to depend. Chromophores are defined as groups unsaturated by constitution and auxochromes as groups unsaturated by nature. In the text proper, the influence of structure upon color is first pointed out by an examination of various colored hydrocarbons. This is followed by a discussion of the rôle of different chromophores and auxochromes in producing color changes and the effect of the introduction of various radicals in different positions with respect to chromophores and auxochromes. The influence of solvents, temperature, and light is then examined, and finally the relation of the unsaturated groups to other physical and chemical properties is discussed.

Pigments: Their properties and tests, "TECHNICUS" (*London: Scott, Greenwood & Son, 1924, pp. VII+68*).—This pocket manual contains general directions for the testing of dry pigments, the extraction of pigments from oil paints, the determination of the specific gravity of pigments, and the staining power, opacity, and flame tests. Various pigments classified under color are then described briefly as to common name, chemical composition, properties, adulterants, and principal tests. Information on the solubility of pigments in acids is summarized in a chart. To add to the usefulness of the manual, blank pages are provided opposite the descriptions of the individual pigments to record special points coming under the observation of the worker.

Agricultural chemistry [studies at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 188 (1924), p. 7*).—Progress is reported on the following studies:

The vitamin content of evaporated milks, R. A. Dutcher, E. Francis, and W. B. Combs.—As the result of the usual feeding experiments conducted on

rats in cages provided with screen bottoms to prevent access to feces, it has been concluded that evaporation of milk by the air blast and vacuum methods does not injure vitamin B to any marked extent, although slight destruction may take place. In sterilized evaporated milk there was evidence of some destruction of vitamin B, particularly when the air blast method was used.

The determination of nitrogen in connection with the wet combustion method for carbon, A. K. Anderson.—The author, with the assistance of H. S. Schutte, has devised a method of determining both nitrogen and carbon in the same sample as follows: The sample is first heated with concentrated sulfuric acid and aerated to remove the hydrochloric acid formed from chlorides which may be present, and is then treated with chromic acid for the determination of carbon by the wet combustion method. The residue from this determination is made alkaline and distilled as in the usual Kjeldahl method. It is stated that nitrogen values determined in this way agree very closely with those obtained by the Kjeldahl method.

Vanilla extracts, H. B. Pierce and W. B. Combs.—In experiments conducted by the authors, with the assistance of W. F. Borst, it was found impossible to distinguish between the flavor of the better grades of true and artificial vanilla extracts when used as flavoring agents in standard ice cream mixes. The lead number was found to be the only chemical test serving to distinguish between true and artificial extracts.

Bread troubles in the light of hydrogen-ion concentration, R. J. CLARK (*Cereal Chem.*, 1 (1924), No. 4, pp. 161-167).—This is a general discussion of the significance of H-ion concentration determinations in judging bread quality.

Lipoids, a factor influencing gluten quality, E. B. WORKING (*Cereal Chem.*, 1 (1924), No. 4 pp. 153-158).—Evidence is presented in this preliminary report that lipoids, if present in flour in considerable amounts, injure the quality of the gluten. Prolonged washing with distilled water of the soft gluten from low grade flour was found to remove appreciable amounts of phosphatides and to increase gradually the tenacity of the gluten until it was practically equal to that of patent flour. Similarly, the addition to crude gluten from patent flour of wheat phosphatides, egg lecithin, and other colloids injured the quality of the gluten as measured by the feel of the hand-washed gluten, by viscosity as measured by the MacMichael viscosimeter, and by baking tests. It is suggested that the change in viscosity of flour following the removal of salts, as reported by Sharp and Gortner (*E. S. R.*, 50, p. 503), may be due in part to the removal of lipoids and other water-soluble material, and evidence in support of this is submitted.

The effect of heat on the activity of the enzyme peroxidase as found in milk, G. SPITZER and M. C. TAYLOR (*Jour. Dairy Sci.*, 7 (1924), No. 3, pp. 234-244, figs. 2).—In this contribution from the Indiana Experiment Station the destruction of peroxidase in milk held at different temperatures for varying periods of time was determined by using the Storch test and comparing the color obtained with that of a series of standards prepared by diluting raw milk in different proportions with milk sterilized by heating to from 95 to 98° C. for 30 minutes.

On plotting the enzyme concentration at different intervals of time, the resulting curves for the different temperatures were similar to logarithmic curves. Milk heated to 62.5° and held at that temperature for 20 minutes lost little of its peroxidase activity, but heated to 85° and kept at this temperature for less than 3 seconds (condition for regular flash sterilization) lost almost all of its peroxidase activity. Tables are included giving calcu-

lated values of the velocity constant K of the reaction of destruction at several different temperatures.

Effect of insulin on the lactic fermentation, A. A. NOYES and H. W. ESTILL (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 10, pp. 415-418).—With a view to obtaining a more satisfactory method than the animal test for the assay of insulin, an investigation, of which this is a preliminary report, was undertaken of the effect of insulin upon the lactic fermentation of glucose by *Lactobacillus bulgaricus* and *L. acidophilus*.

"The results of this investigation may be summed up in the statement that insulin has been proved to increase substantially (by 20-25 per cent) the quantity of acid produced by the fermentation of glucose under the influence of the organism *L. bulgaricus*, and to a less extent under that of *L. acidophilus*. Whether this effect is due to stimulation of the growth of the organism, to increase in the decomposition of the glucose through co-enzyme action or to some other cause has not been determined. From the viewpoint also of developing a method of assaying insulin, the research is to be regarded as only a preliminary one; and it is to be continued in this direction, so as to find the best conditions for producing the maximum effect and for yielding concordant results in duplicate experiments and to determine how the magnitude of the effect varies with the concentration of the insulin."

A mixed indicator for carbonate-bicarbonate titrations, S. G. SIMPSON (*Indus. and Engin. Chem.*, 16 (1924), No. 7, p. 769).—A study of various indicators for carbonate-bicarbonate titrations has led to the selection, as most suitable, of a mixture of 3 drops cresol red and thymol blue (1 volume to 2) for the first end point, and of 4 drops of bromophenol blue for the second. The indicators are prepared as described by Clark (*E. S. R.*, 45, p. 11).

On the determination of arsenic, chiefly in dipwashes, J. P. VAN ZYL (*Union So. Africa Dept. Agr., Rpts. Dir. Vet. Ed. and Research*, 9-10 (1923), pp. 781-795).—An extensive comparison of various methods of determining arsenic in dipwashes is reported.

Three series of analyses were made with nine different methods. In the first series, standard solutions were prepared of sodium arsenite alone and in combination with phenol, soap, tar, paraffin, soil, and manure. The second series consisted of samples of commercial dips and field samples of varying degrees of contamination. The third series was arranged particularly to test the effect of different methods of clarification upon the determination. The chief points of interest brought out by the data obtained are summarized essentially as follows:

In the case of turbid dips a reliable method of clarification is essential, and for this heating with animal charcoal and sulfuric acid was found to be satisfactory. If the solution has first been clarified by this method, the method for total arsenic by reduction of arsenate to arsenite with thiosulfate has been found to give excellent results, but if the solution has not been clarified the end point is in some cases difficult to determine. Reduction of arsenate with potassium iodide and sulfuric acid was found to give correct results with or without clarification, but the Chapin method for total arsenic is considered preferable for routine work.

Fair but not altogether reliable results were obtained by direct titration of the unclarified solution with iodine in the presence of sufficient bicarbonate, but the results were much too low if no bicarbonate was present. Clearing the sample by means of crude bisulfate was found to involve a slight loss of As_2O_3 , but the method is considered justifiable for field control. The results obtained on solutions made up with ordinary hard water agreed well with the theoretical values.

On the measurement of hydrogen-ion concentrations in soil by means of the quinhydrone electrode, E. BILMANN (*Jour. Agr. Sci. (England)*, 14 (1924), No. 2, pp. 232-239 figs. 2).—The theory on which the use of the quinhydrone electrode is based and the method of preparing the electrode are described briefly, and data are presented and discussed on its use in the determination of the H-ion concentration of soil extracts and suspensions.

Extracts of three different soil samples were each tested with three quinhydrone standard electrodes, and it was found that the greatest difference between the potentials for the same soil extract was 0.0025 volt, a sufficiently satisfactory agreement. The pH values of seven different soil samples were determined colorimetrically with bromothymol blue and α -naphtholphthalein as indicators and with the quinhydrone capillary electrode. The average variation between the pH values for each sample was only 0.07. Mixtures of soil and water were finally examined by the ordinary quinhydrone electrode, using in one case electrode vessels of the calomel electrode type and in the other ordinary test tubes. In the latter case 5 gm. of the soil sample was shaken for a short time in a test tube with 20 cc. of boiled distilled water and a few centigrams of quinhydrone. The platinum electrode was placed in this mixture and a cell formed by hanging the standard electrode on the edge of the test tube so that the end of the siphon tube dipped a few millimeters into the liquid in the test tube. The results obtained by the two methods showed satisfactory agreement except that the values were slightly lower in the test tube experiments.

In conclusion data obtained by Christensen and Jensen on the application of the method on a large scale to the determination of H-ion concentrations in soils are reported. These have been noted previously from another source (E. S. R., 51, p. 805).

The determination of nitrate and ammonia in nitrogenous materials, O. M. SHEDD (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 6, pp. 527-539).—This contribution from the Kentucky Experiment Station consists of a comparison of the Strowd method of determining nitrates in plants (E. S. R., 44, p. 504) with a modified procedure and a comparison of the modified method with the Ulsch-Street method for determining nitrate in fertilizers and of these two with the Official magnesium oxide method for determining ammoniacal nitrogen in fertilizers. The modification of the Strowd method consisted chiefly in allowing the reduction with the Devarda alloy to continue for 24 hours at room temperature previous to heating the solution.

Concordant results were obtained with the original and modified methods in the recovery of nitrates from solution and nitrates added to tobacco of low nitrate content, but more consistent and generally higher results were obtained with the modified method when nitrates were determined in different kinds of tobacco of variable nitrate content. The modified method and the Ulsch-Street method were both satisfactory for nitrates in commercial fertilizers, although in some cases lower results were obtained with the latter method.

The control determination in the modified method proved as accurate for the determination of ammoniacal nitrogen in fertilizers as the Official magnesium oxide method provided the solution was filtered. Filtration proved of small advantage if nitrate determinations alone were to be made.

"The modified Strowd method is not recommended for general application for nitrate determinations until its reliability is established, but it is believed that its use can be extended to others of a different nature from those employed in this investigation."

Determination of moisture in wheat and flour, Part I, H. SNYDER and B. SULLIVAN (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 741-744).—A comparison is reported of moisture determinations on flour by means of air oven drying for 5 hours at 105° C., water oven drying for the same length of time, and vacuum oven drying at 100° and a vacuum of from 600 to 750 mm.

The average loss in weight from 28 samples of flour was 11.78 per cent in the water oven as compared with 13.21 per cent in the air oven and 13.8 per cent in the vacuum oven. The factors causing these variations are discussed.

Influence of several solvents on the Hanus iodine values of cottonseed and coconut oils, H. J. BANKSTON, JR., and F. C. VILBRANDT (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 707, 708, figs. 2).—Data are reported on the determination of the iodine numbers of cottonseed and coconut oils by the Hanus method, with the use of varying amounts of different solvents. Variable and inconsistent results were obtained with alcohol, ether, and benzene. The values obtained with carbon tetrachloride were consistent provided 15 cc. or more of the solvent was used with 0.5 gm. of the oil. With chloroform higher and more consistent values were obtained for cottonseed oil than those obtained with carbon tetrachloride, but the results with coconut oil were very little affected by the use of chloroform.

Determination of dry substance in beet sugar juices, R. J. BROWN (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 746-748).—This is a preliminary report on the selection of a method of determining dry substances in thin sugar juices to an accuracy of 0.01 per cent. Gravimetric methods were considered most suitable, and a comparison was made of the Spencer oven and the Freas vacuum oven. The first was found to give results checking within from 0.01 to 0.04 per cent and is considered satisfactory for rapid routine work but not for work requiring extreme accuracy. With the Freas vacuum oven satisfactory results were obtained with the following technique: Twenty-five gm. of acid-washed, ignited sand is weighed into an aluminum dish containing a glass stirring rod, heated for 15 hours at from 70 to 75° C. with 120 mm. absolute pressure, cooled in a desiccator, and weighed. To this is added 5 cc. of the sugar solution from a weighing bottle and the mixture heated in the same way, cooled in the desiccator for not more than 1 hour, and weighed rapidly.

Super-defecation of cane juice, W. D. HORNE (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 732, 733).—"The process here described has been devised to secure the advantages of complete precipitation of all the impurities that lime will throw down, without incurring the disadvantages of working up a highly alkaline juice. This is accomplished through a patented process by liming to a certain point between alkalinity to litmus and alkalinity to phenolphthalein, heating, settling, and decanting. The decanted juice is then treated with a specially prepared phosphatic reagent which precipitates the lime and other bases; the solution is slightly reheated and settled. The juice, thus raised considerably more than usual in purity, and lighter colored and cleaner, yields more abundant and more readily worked sugars. The phosphatic precipitate is used as cane fertilizer, thus conserving its cost."

Cornstalk sirup investigations, J. J. WILLAMAN, G. O. BURR, and F. R. DAVISON (*Minnesota Sta. Bul.* 207 (1924), pp. 5-58, figs. 21).—This is a report of an investigation of the sirup-making possibilities of the stalks of sweet corn as a cannery by-product.

The factors upon which depends the development in the cane of the maximum quantity of juice of the best quality were first considered. Several varieties of sweet corn and field corn were used for analyses of the juice of

the stalk at the time of removal of the ears for canning and after standing in the field with and without removal of the ears. The juice of the stalks at the canning stage had a density of from 9 to 11° Brix, but that of stalks which had stood for from 10 to 20 days after the removal of the ears had a density of from 13 to 17°. The juice of stalks from which the ears had not been removed did not increase in density. Simultaneously with the increase in density of the juice during the ripening period after the removal of the ears, other changes in composition took place including a slight increase in acidity, a large increase in total and protein nitrogen, in substances precipitated by alcohol, and in sugars, chiefly sucrose, and no change in mineral content.

The quotient obtained by dividing the total solids of the juice as determined with the Abbé refractometer by the degrees Brix was found to be a valuable index of the quality of the juice for sirup making. It is suggested tentatively that any juice with a quotient of 94 or less be considered unsuitable for sirup making.

With the exception of one lot of Evergreen corn which was found to have excessive quantities of potassium nitrate, the juice obtained from the different varieties was of about the same quality. Some evidence was obtained that during cool, moist weather the mineral content of the juice is low and the purity high, the reverse being true for hot, dry weather. The quality of the juice was not seriously impaired after the cornstalks had stood in the shock for at least 2 days.

The general process followed in making experimental lots of sirup was essentially as follows: The clean stalks, with ears, leaves, and tassels removed, were milled once in a three-roll mill. The juice was heated to boiling and after removal of the scum was treated with lime, kieselguhr, or carbon, and then evaporated, preferably in a vacuum evaporator, to a content of from 73 to 76 per cent solids. It was found that the methods adopted as most satisfactory for making sorghum sirup (E. S. R., 42, p. 713) were applicable to the manufacture of cornstalk sirup with the exception of the control of acidity. In the cornstalk juice considerable changes in acidity were brought about by heat and by the addition of kieselguhr and carbon. The carbons proved valueless in the treatment, but kieselguhr proved an excellent filter aid. The method of defecation and filtration recommended as most satisfactory consists in heating the juice by steam in defecators just to the boiling point, titrating, and adding lime to reduce the acidity to about 12°, after which kieselguhr is added to about 1 per cent of the weight of the juice. The juice is then stirred and immediately pumped through a filter press which has been precoated with kieselguhr. The juice is finally evaporated in a vacuum evaporator to a density of from 75 to 78°. The sirup is said to be of a reddish amber color, with a pleasant flavor, and to rival the best grades of sorghum and molasses as a cooking sirup.

The economic considerations for the manufacture of cornstalk sirup are summarized as follows: "The possibilities of the successful commercial manufacture of cornstalk sirup are not yet altogether bright. In the present estimates of cost, it is assumed that \$3 per ton of fresh stalks would be a price satisfactory to the grower. This would amount to from 18 to 21 cts. per gallon of sirup. The cost of manufacture is estimated at 30 cts. The total cost is thus about 50 cts. per true gallon, and could wholesale at about 68 cts. and compete with the best grade of sorghum sirup. Assuming a capital outlay of \$60,000, the returns at this price for sirup would be about 11 per cent. These figures allow for the utilization of bagasse and leaves. It would be difficult to say whether these costs could be materially reduced in actual

practice, and whether the profits as indicated would make the venture attractive."

Cornstalk sirup investigations, J. J. WILLAMAN, G. O. BURR, and F. R. DAVISON (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 734-739).—A briefer account of the investigation noted above.

Some chemical aspects of sweet corn drying, C. O. APPLEMAN (*Maryland Sta. Bul.* 267 (1924)), pp. 287-298).—Supplementing previous work (E. S. R., 49, p. 832) data on the loss of sugar from sweet corn after picking and during various processes employed in drying are reported and discussed.

The best stage for picking corn for drying is considered to be the late milk stage when the corn contains from 75 to 78 per cent of water and from 10 to 12 per cent of starch. If immature the kernels shrink badly and are apt to turn black on drying, while if too mature the kernels will be tough and lacking in sweetness. To retain the natural sweetness the corn should be picked early in the morning and prepared immediately for drying.

Blanching in boiling water for 10 minutes did not extract any appreciable amount of sugar from the corn, but did not prevent the loss of sugar on subsequent drying in the sun. Sun drying is considered to be impracticable in Maryland owing to the uncertain weather conditions prevailing during the sweet corn season. When dried by artificial heat the carbohydrate changes during drying at 176 and 212° F. were insignificant in corn which had been blanched for from 3 to 5 minutes. At 158° there was some conversion of sucrose into reducing sugars. The best results were obtained by heating the corn as rapidly as possible to a temperature near the boiling point of water, drying at this temperature for from 3 to 4 hours, and completing the drying at moderate temperatures. Frequent stirring of the corn while drying and removing it from the drying temperature as soon as it had dried sufficiently were found to prevent blackening of the corn.

Olive pickling in Mediterranean countries, W. V. CRUESS (*California Sta. Circ.* 278 (1924), pp. 33, figs. 19).—Following cultural notes abstracted on p. 237, a detailed description, based upon observations made in Spanish olive orchards and factories and illustrated by photographs, is given of the process of pickling green olives in Spain. Brief descriptions are also given of French, Greek, and miscellaneous European processes for pickling olives, with suggestions for the possible adaptation of some of the processes to the preparation of olives in California.

METEOROLOGY

Forecasting seasonal rainfall from ocean temperatures, G. F. McEWEN (*Bul. Amer. Met. Soc.*, 5 (1924), No. 10, pp. 137-139, fig. 1).—It is stated that "investigations have shown that summer temperatures of the California coastal waters are lower or higher in proportion as the Pacific 'high' is of greater or less intensity, and accordingly low summer temperatures should be followed by a seasonal rainfall greater than the average and high temperatures should be followed by a seasonal rainfall less than the average. The observed correlation between temperature and rainfall for the past eight years accords with the above hypothesis. A change of 1° F. has been found to correspond on the average to 2 in. of rain over the coastal region of southern California."

Data for the eight years 1916-1924 and the rainfall indications for 1924-25 are summarized. It is stated that "if the relation thus indicated continues to hold, the 1924-25 seasonal rainfall will be about 17 in., or 5 in. above the average for the last eight years."

The eleven-year sun spot period and seasonal and regional temperature fluctuations in the Northern Hemisphere [trans. title], B. DROSTE (*Met. Ztschr. [Brunswick]*, 41 (1924), No. 9, pp. 261-268, fig. 1).—The sun spot effect on temperature is stated to be greatest as a rule in winter and decidedly less in summer and as the yearly average. The effect is positive for the greater part of the Northern Hemisphere, but is negative in certain widely distributed regions. The areas of direct agreement of temperature with sun spot frequency extends to America as well as Eurasia, and the regional variations are stated to be in accord with Köppen's conclusion that the mean temperature of the earth's surface as a rule varies inversely as the sun spots.

Meteorological observations, 1922 (*Guam Sta. Rpt. 1922*, p. 20).—Observations on atmospheric pressure, temperature, precipitation, and velocity and direction of the wind as recorded at the Guam Experiment Station are summarized for the year ended June 30, 1922.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and J. BOWER, JR. (*Massachusetts Sta. Met. Buls.* 429-430 (1924), pp. 4 each).—Summaries are given of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during September and October, 1924. The data are briefly discussed in general notes on the weather of each month.

Nitrogen in the rainwater at different points in Kentucky, J. F. FREEMAN (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 6, pp. 356-358).—Determinations of total, ammoniacal, and nitrate nitrogen in samples of rain water collected at seven places are reported. The average annual rainfall of six of these places was 42.76 in. The average ammoniacal nitrogen brought down per acre was 11.61 lbs., nitrate nitrogen 7.17 lbs., and total nitrogen 18.78 lbs.

Sulfur in rainfall in Kentucky, E. M. JOHNSON (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 6, pp. 353-356).—The sulfur content of rainfall collected at seven different places in the State is reported. With annual rainfalls varying from 41.37 to 49.62 in., and an average of 44.77 in., the sulfur per acre-inch of rainfall varied from 0.41 to 0.94 lb. per acre. The average annual precipitation of sulfur varied from 17.1 to 41.19 lbs. per acre, with an average of 29.52 lbs. The sulfur precipitation was greater in winter than in summer.

Results obtained by other investigators are summarized, and a list of 10 references to literature cited is given. The unreliability of estimates of annual precipitation of sulfur based on examination of a few samples of rainfall is pointed out.

SOILS—FERTILIZERS

The composition of the earth's crust, F. W. CLARKE and H. S. WASHINGTON (*U. S. Geol. Survey, Prof. Paper 127* (1924), pp. V+117).—A large amount of data is presented which may be of interest in the study of soils.

A statistical study of the distribution of soil material in the United States according to the size of its particles, D. S. JENNINGS (*Soil Sci.*, 17 (1924), No. 6, pp. 469-485, figs. 5).—In a contribution from the Utah Experiment Station histograms representing the average textural composition of the 13 soil divisions of the United States are presented. These have been worked out from the data obtained from U. S. D. A. Bureau of Soils Bulletin 96 (*E. S. R.*, 30, p. 19).

It was found that the ratio of the area of separate 5 to the total area is approximately constant for the 13 divisions. This ratio, expressed as a percentage, is 14.32 ± 0.39 . The standard deviation and probable errors are less for separate 5 than for separates 4, 6, and 7, while the coefficient of variability is less for separate 5 than for any other separate except 1. The same relative

condition with respect to separate 5 maintains for 229 smaller areas well distributed throughout the United States.

Each histogram was characterized by a mode in either separates 4 or 6, and the constancy of separate 5 is explained on this basis. A study of the distribution of the soil from several parent rock types to explain the position of the mode showed that (1) quartz-bearing igneous rocks tend to give soils low in silt and high in sand and clay, (2) soils the parent rock of which are mixtures of sandstone and shale approximate the average texture, and (3) limestone, slate, shale, and loessial material tend to give soils of high silt and low sand content.

These criteria are applied to 8 of the 13 soil divisions and offer an explanation of the distribution of soil classes. It is also shown that the general mean, which probably represents the average soil class of the United States, is a loam.

The value of soil analysis when limited to an intensive single cropping system. W. T. McGEORGE (*Soil Sci.*, 17 (1924), No. 6, pp. 457-462).—In a contribution from the Hawaiian Sugar Planters' Experiment Station, a summary of information on methods of soil analysis which are applicable to the solution of soil fertility problems involved in an intensive single cropping system such as is practiced on sugar plantations is presented.

In this connection it is stated that the 1 per cent citric acid test is being extensively applied as a guide to fertilizer policy on the sugar plantations. A definite relation has been noted between forms of silica and lime present in Hawaiian soils as well as the soil reaction and availability of phosphoric acid. It has also been found that the response to phosphate manuring is typical of upland areas and is rarely obtained on lowland soils. The availability of potash appears to be influenced by the physical composition, lime content, and reaction of the soil, with an additional association of low availability in districts of heavy rainfall.

Hancock County soils. R. S. SMITH, E. E. DE TURK, F. C. BAUER, and L. H. SMITH (*Illinois Sta. Soil Rpt.* 27 (1924), pp. [2]+62, pls. 2, figs. 9).—This survey deals with the soils of an area of 489,523 acres in the extreme western part of Illinois. The county is divided into two principal drainage areas, one draining into the Mississippi and the other into the Illinois River. By far the largest part of the soil material has been transported and deposited upon the drift by wind. Exclusive of bottom land, the county includes (1) two areas of deep loess along the Mississippi bluff, (2) a comparatively small area in the north-central part of the county made up of soils having very pervious subsoils, and (3) an area in which the subsoils are less pervious to water and air.

The soils are grouped as upland prairie, upland timber, terrace, old bottom land, late bottom land, and residual soils. Twenty-three soil types are mapped, of which the brown silt loam upland prairie soil and the yellow gray silt loam and yellow silt loam upland timber soils cover 33.35, 21.73, and 19.1 per cent of the area, respectively.

Analyses and field experiments are also reported to determine the fertility requirements and crop adaptations of the prevailing soil types. Explanations for interpreting the soil survey and information on the principles of soil fertility are appended.

A supplement containing experimental field data from fields on soil types similar to those occurring in the county is also included.

Soil survey of Cole County, Missouri. A. T. SWEET and R. WILDERMUTH (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1920, pp. III+1501-1530, pl. 1, fig. 1, map 1).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 248,960 acres lying in

the center of the State of Missouri. The greater part of the county is undulating, rolling, or broken upland. The remainder consists of terrace and bottom land. Nearly every part of the upland is well drained. The stream terraces are usually rather poorly drained and most of the first bottoms are subject to occasional overflow.

The soils of the county are of residual, loessial, and alluvial origin. Including river wash, 16 soil types of 9 series are mapped, of which the Union silt loam and stony loam cover 45.3 and 19.6 per cent of the area, respectively.

Soil survey of Benton County, Oregon, E. J. CARPENTER and E. F. TORGERSON (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+1431-1474, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Oregon Experiment Station, deals with the soils of an area of 414,720 acres lying in the Pacific coast soil region in middle-western Oregon. Approximately three-fourths of the county lies in the drainage area of the Willamette River and one-fourth on the western slopes of the Coast Range. The valley areas consist of alluvial flood plains and alluvial terraces and valley slopes. The alluvial flood plains are largely subject to periodic overflow. For the most part the surfaces of the terraces and valley slopes are smooth to gently undulating, and some of the smoother areas have very poor natural drainage.

The soils of the county are said to vary in productiveness, drainage usually being the limiting factor. Including river wash and rough mountainous land, 25 soil types of 17 series are mapped, of which the rough mountainous land covers 37 per cent of the area. The Aiken silty clay loam is the most extensive classified soil type.

Representative Transvaal soils.—VIII, The Waterberg sandy soil, B. DE C. MARCHAND (*Union So. Africa Dept. Agr. Jour., 9 (1924), No. 1, pp. 80-84*).—In a further contribution to the subject (*E. S. R., 51, p. 721*), a description is given of the nature, origin, and chemical and mechanical composition of the Waterberg sandy soil. This soil is almost invariably brown in color. The texture is loose and sandy, and as a rule some coarse gravel occurs, especially at a depth of 10 in. or more. There is no sharp line of demarcation between the surface and the subsoil. This soil is derived from the sandstones of the upper series of the Waterberg system.

The mechanical analyses indicate that these soils consist for the most part of sand, the silt and clay fractions amounting to from 9 to 12 per cent only. They are pervious, retain water poorly, become very hot, are readily soaked, and dry out just as rapidly, soon showing the effects of drought. The chemical analyses indicate that these soils are usually decidedly acid and are generally deficient in organic matter and in nutritive constituents.

Further studies on soil profiles, M. M. McCool and A. G. WEIDEMANN (*Soil Sci., 18 (1924), No. 3, pp. 181-183*).—Further studies on the subject, conducted at the Michigan Experiment Station (*E. S. R., 50, p. 617*) to bring out differences that may occur chiefly in the colloidalilty of various horizons in several profiles, are reported. Both mineral and muck soil profiles were studied, and the heat-of-wetting method was used to determine the differences.

The data show that the heat of wetting with water of the humus horizon is much greater than that of the other horizons, and that the heat of wetting of organic soils with water is many times greater than that of mineral soils. In some profiles the heat of wetting of the humus horizon with nitrobenzole and absolute alcohol was slightly greater than that of the other horizons, but in a few cases it was actually lower. There was not very much difference in the heat of wetting of the mineral horizons with the different liquids used. These differences are considered to be significant in that in a given soil profile there

are horizons that react quite differently to a given liquid and also to different liquids when brought into contact with them.

Factors influencing the binding power of soil colloids, H. E. MIDDLETON (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 6, pp. 499-513, figs. 6).—Studies conducted by the U. S. D. A. Bureau of Soils on the factors influencing the binding power of soil colloids and the relation of the compressive strength of soil to the amount of colloidal material present therein are reported.

A method was deduced for testing the binding power of soil colloids by determining the breaking strength of briquets molded from soils under definitely established conditions.

The factors influencing the breaking strength of a briquet were found to be (1) the amount of moisture present at the time of molding, (2) the treatment of the material before molding the briquet, (3) the pressure applied, and (4) the manner of drying. Some of the factors found to affect the binding power of soil colloids are (1) the amount of colloid present, (2) the size and grading of the noncolloidal material, (3) the kind of colloid, and (4) the dispersion of the colloid.

A general relation between the load per gram of soil, L , and the amount of colloid in the soil in per cent, C , was deduced and given expression in the formula, $L=0.42 C^{1.24}$.

Nitrification in some South African soils, Part II, T. D. HALL (*Soil Sci.*, 18 (1924), No. 3, pp. 219-235, figs. 3).—A continuation and extension of studies on the subject at the School of Agriculture and Experiment Station at Potchefstroom, South Africa (*E. S. R.*, 46, p. 514), are reported.

The results confirmed the original conclusion that nitrification in South African soils is not as active as it has been found to be in California soils and soils from the more humid portions of North America. They indicated that moisture and aeration are apparently factors influencing nitrification under the climatic conditions of South Africa more than temperature. The seasonal variation study showed a nitrate production which would be adequate for most crops on these soils. The drying of the soil in winter and also the frost appeared to improve the nitrifying power when conditions again became favorable for nitrification.

In the soil studied there was very little nitrification in samples taken below the first foot, although traces of such activity could be found to the sixth foot in cultivated fallow. It was found that for a nitrate determination only, a soil sample can be allowed to dry out, if thinly spread in the laboratory, without the nitrate content being appreciably affected. Nitrification was found to be quite good in two of three acid soils studied, and it was not much improved by liming. Nitrification was found to be satisfactory in the Rustenburg tobacco soils with the exception of two types. In most cases the subsoils nitrified better than the surface soils.

[Soil fertility studies of the Indiana Station] (*Indiana Sta., Soil Fertility Invest., Francisco Field, 1917-1922 and 1917-1923, pp. 4 each, fig. 1 each; Worthington Field, 1913-1922 and 1913-1923, pp. 4 each, fig. 1 each; Jennings Co. Field, 1921-1923, pp. 6, fig. 1; North Vernon Field, 1913-1923, pp. 4, fig. 1; Scottsburg Field, 1906-1923, pp. 4, fig. 1; Soils and Crops Expt. Farm, 1915-1923, pp. [1-5], fig. 1; Moses Fell Annex Rpt., 1923, pp. 1-9, figs. 2).*

—The results of experiments at the above points are summarized.

Soil improvement: Fertilizers and their use, J. RUSSELL (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 3, pp. 217-223).—In a brief contribution from the Rothamsted Experimental Station a summary is made of available knowledge on the selection and use of nitrogenous, phosphatic, and potassic ferti-

lizers, and of natural manures. Special reference is made to the progress of findings at the station.

The relation of manure to the nutritive and vitamin value of certain grain, R. McCARRISON (*Brit. Med. Jour.*, No. 3300 (1924), pp. 567-569).—Studies are reported which showed that in all probability natural manures are superior to artificial fertilizers in influencing the nutritive and vitamin values of food grains.

Decomposition of calcium cyanamide on storage, K. D. JACOB, H. J. KRASE, and J. M. BRAHAM (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 684-688, figs. 2).—In a contribution from the U. S. D. A. Fixed Nitrogen Research Laboratory the results of a study are reported on the nature and extent of the decomposition of calcium cyanamide under various storage conditions in quantities ranging from a few kilograms to 450 metric tons. Some of the observations covered a period of 2.5 years.

When calcium cyanamide was exposed in small lots to unusually severe conditions of humidity and temperature for long periods, the cyanamide nitrogen was completely changed into other forms, principally dicyandiamide and urea in the approximate proportions of from 70 to 75 and from 20 to 22 per cent, respectively, of the total nitrogen. In such a case from 7 to 8 per cent of the total nitrogen was lost as ammonia.

Untreated calcium cyanamide decomposed more rapidly than hydrated and oiled material. The decomposition of properly hydrated and oiled calcium cyanamide stored in 45-kg. bags over a period of six months was small under normal storage conditions as regards temperature and humidity. The decomposition of calcium cyanamide stored in bulk in such a manner that only a relatively small surface was exposed to the atmosphere, as in a silo, was almost negligible, the changes being confined largely to the top 20 cm.

The losses of nitrogen from calcium cyanamide stored in a silo were greatest in the first 10 cm. of material, where the maximum quantities of water and carbon dioxide were absorbed. This loss progressively decreased with increasing depth in the material. Loss of nitrogen apparently occurred in two stages—a slight loss occurring when the freshly prepared calcium cyanamide was first placed in storage and further losses occurring as the calcium cyanamide decomposed. After 30.5 months' storage 8.6 and 5 per cent, respectively, of the total nitrogen originally present was lost from the 0 to 5 and 15 to 20 cm. layers of material.

Preparation of guanidinium salts from calcium cyanamide, J. S. BLAIR and J. M. BRAHAM (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 848-852, figs. 6).—In a contribution from the U. S. D. A. Fixed Nitrogen Research Laboratory a description is given of the conditions under which about 80 per cent of the cyanamide contained in aqueous solutions may be converted to guanidinium salts by heating under pressure with ammonium salts.

The influence of silica, lime, and soil reaction upon the availability of phosphates in highly ferruginous soils, W. T. McGEORGE (*Soil Sci.*, 17 (1924), No. 6, pp. 463-468).—Studies conducted at the Hawaiian Sugar Planters' Experiment Station are reported which showed that there is a definite relation between the availability of silica and phosphoric acid in Hawaiian soils as measured by the response of sugar cane to phosphate manuring. The reaction of the soil and the forms of lime present are also closely related to the availability of phosphoric acid. The application of these theories to field conditions is shown by the relation of acidity and solubility of silica and lime to the phosphoric acid content of cane juice from cane at a particular plantation.

The availability of phosphorus in calcareous and noncalcareous soils, J. W. AMES and C. J. SCHOLLENBERGER (*Ohio Sta. Bul. 380 (1924), pp. 215-242*).—Data obtained from analyses of wheat grown on fertility plats with and without lime to determine the influence of lime upon phosphorus assimilation are reported.

During the first years of the test wheat grew well on the cylinders, but the yields and composition of the crops indicated that phosphorus was not the limiting factor. Clermont silt loam was the only soil furnishing any indication that lime depressed the availability of native soil phosphorus. Clyde clay and Dunkirk sandy loam gave inconclusive evidence that lime caused increased removal of phosphorus from the unfertilized soil. Upshur clay indicated no effect due to lime. Volusia silt loam and Wooster silt loam bore increased crops as the effect of lime alone, and phosphorus removal from the unfertilized soil was increased by lime.

Lime caused no change in the average phosphorus content of grain grown on fertilized Clermont silt loam. The average yield was slightly increased by lime applied to fertilized cylinders of Clyde clay, and the phosphorus percentage in the grain was increased.

The yields of wheat upon fertilized Dunkirk sandy loam were adversely affected by lime, and the average removal of phosphorus was less from limed cylinders. The average percentage of phosphorus in the grain was greater in the crop from limed cylinders.

Analyses of oat plants indicated that the difference in the phosphorus content of the crop due to fertilization becomes less as the age of the plant increases. Millet grown on cylinders and cut at an early stage contained more phosphorus when grown on limed unfertilized cylinders of every soil except Clyde clay.

An experiment with an artificial root indicated but slight differences in the availability of phosphorus due to lime, except in the case of the Wooster silt loam.

After eight years in the cylinders, the most pronounced changes in the composition of the soils were in the calcium soluble in dilute acid and in the reaction. The soils had become much more acid, and appreciable changes in the solubility of phosphorus, indicating depletion as the result of cropping, were noted in two cases. In every case the organic phosphorus content was higher in the unlimed cylinder than in the original soil.

Phosphate fertilizers for soil improvement, H. W. WARNER (*Iowa Agr. Col. Ext. Bul. 118 (1924), pp. 8, figs. 7*).—Practical information on the selection, purchase, and use of phosphorus fertilizers for Iowa soils is presented.

Preparation of phosphoric acid, W. H. ROSS, A. L. MEHRING, and R. M. JONES (*Indus. and Engin. Chem., 16 (1924), No. 6, pp. 563-566*).—In a contribution from the U. S. D. A. Bureau of Soils studies are briefly reported which showed that a mixture of calcium phosphate, silica, and carbon containing from 1 to 3 molecular equivalents of lime to 1 of silica and 5 of carbon loses upwards of 90 per cent of the phosphorus present when ignited at 1,300° C. for one hour under reducing conditions. It was demonstrated that the loss of phosphorus is not due to a replacement of phosphoric acid by the less volatile silicic acid but to one or more of several reactions, depending on conditions, in which both silica and carbon play a part.

The same loss of phosphorus occurs when sand is replaced by an equal weight of potash shale, and when the lime in the mixture is three times the equivalent of the silica present loss of potash as well as phosphorus begins at 1,050°, and at 1,300° upwards of 90 per cent of both escapes from the charge.

Little or no fusion occurs below 1,300° when the charge contains less than 20 per cent of sand or shale and upwards of 25 per cent of carbon. Wet oxidation of the volatilized product yields a solution of potassium phosphate in phosphoric acid. The loss of phosphorus from a mixture of 5 parts of calcium phosphate and 1 of carbon without added silica amounts to 45 per cent at 1,300° and is complete at 1,550°, leaving an unfused residue of calcium oxide.

A biological measurement of the availability of potassium in soils, D. E. HALEY (*Pennsylvania Sta. Bul. 188 (1924), p. 8*).—Preliminary experiments, using the water extraction method, are reported to have shown that soils treated with potassium over a period of years yielded no more potassium than soils in the immediate vicinity receiving no potassium treatment. Sand culture experiments indicated that buckwheat can absorb relatively larger quantities of potassium from a treated soil.

Soil potassium as affected by fertilizer treatment and cropping, J. W. AMES and R. H. SIMON (*Ohio Sta. Bul. 379 (1924), pp. 183-212, fig. 1*).—The results of water and weak acid extractions made of soils from fertility experiment plats to determine the influence of additions and cropping upon the solubility of potassium are reported.

The dilute acid results showed that the supply of active potassium in silt loam soil was gradually depleted where larger yields were produced by the addition of lime and acid phosphate. The amounts of water-soluble potassium were slightly increased in some soils fertilized with sodium nitrate. The residual potassium from additions of potassium chloride and manure was indicated by an increased amount of soluble potassium removed from soils, this being largest in unlimed soil. Approximately the same amount was dissolved from limed soil fertilized with potassium chloride as from unfertilized and unlimed soil.

It was found that an appreciable amount of potassium is carried below the cultivated depth in soil receiving potassium chloride, while potassium supplied by manure was not carried to the subsurface to the same extent. More potassium was absorbed by limed soil that had a larger content of replaceable calcium. The absorption by limed soil was 60 per cent of the potassium content of the solution in contact with the soil, and 42 per cent was absorbed by unlimed soil.

Calcium sulfate, sodium nitrate, ammonium sulfate, and monocalcium phosphate appreciably increased the solubility of potassium in silt loam, clay loam, and clay soils, unfertilized and potassium fertilized, ammonium sulfate having the most pronounced effect. No evidence was obtained that lime increased the solubility of potassium.

Authorizing investigations of potash deposits (*U. S. House Represent., 68. Cong., 1. Sess., Com. Mines and Mining, Hearings on S. 3047, 1924, pp. [2]+22*).—The text of the hearings before the Committee on Mines and Mining of the House of Representatives authorizing joint investigations by the U. S. Geological Survey and the Bureau of Soils, U. S. D. A., to determine the location and extent of potash deposits or occurrence in the United States and improved methods of recovering potash therefrom, is presented.

Liming of soils, J. GUERRERO (*Guam Sta. Rpt. 1922, pp. 14, 15*).—The results of studies begun in 1920 to determine the effect of lime in varying amounts on land which has been under cultivation for some time and on newly broken native grassland are briefly summarized.

The results seem to indicate that lime would very materially benefit newly plowed native grassland and old soil to a certain extent. Apparently applications at the rate of 4 tons to the old soil and 8 tons to the new soil were the most efficient.

Mineral resources of the United States in 1923 (*U. S. Geol. Survey, Min. Resources U. S., Prelim. Summary, 1923, pp. IV+130A*).—This is the sixth annual preliminary summary of the mineral production of the United States, and includes sections on clay, gypsum, marl, peat, phosphate rock, potash, and sulfur.

The Jamshedpur activated sludge sewage disposal works, F. C. TEMPLE and V. N. SARANGDHAR (*Agr. Jour. India, 19 (1924), No. 4, pp. 369-377, pls. 2*).—The purification of sewage by the activated sludge process at Jamshedpur, India, is described, and the results of experiments on the use of activated sludge as a fertilizer as compared with natural and artificial fertilizers are presented. The results are taken to indicate that the activated sludge system is remarkably well suited to Indian conditions, both as a method of sewage purification and as a means of producing a valuable fertilizer.

The home mixing of fertilizer, A. T. WIANCKO (*Purdue Agr. Ext. Bul. 130 (1924), pp. 8, fig. 1*).—Information on the home mixing of fertilizer is presented.

Analyses of fertilizers—spring season, 1924 (*N. C. Dept. Agr. Bul., 1924, July, Sup., pp. 13*).—Guaranties, actual analyses, and relative valuations of 196 samples of fertilizers and fertilizer materials collected for inspection in North Carolina during the spring season of 1924 are presented.

AGRICULTURAL BOTANY

The morphology and physiology of the genus *Eidamia*, A. S. HORNE and H. S. WILLIAMSON (*Ann. Bot. [London], 37 (1923), No. 147, pp. 393-432, figs. 23*).—"The salient morphological features of three species of *Eidamia*, including two which are apparently new to science, are described. The reactions which these species exhibit when grown in various media, including sugars, soluble pectin, protein, organic acids, and various other substances, are compared and contrasted. The growth-limits of the species in relation to H-ion concentration are approximately determined."

Observations on the reaction of protoplasm to some reagents, W. SEIFRIZ (*Ann. Bot. [London], 37 (1923), No. 147, pp. 489-509, figs. 4*).—In this report of work done in the Botanical Institute of the University of Geneva, Switzerland, an account is given in part of the results of experiments on the reaction of living protoplasm to ethyl alcohol and to the glucosides saponin, smilacin, and senegin. Leaves of *Elodea* growing in spring water, which is very pure in Geneva, furnished the material from the superficial cells of the upper leaf surface.

Treatment in ethyl alcohol causes a pronounced stimulation to streaming in the *Elodea* leaf cell. Permeability is increased and the osmotic value, therefore, decreased by brief treatment in a 1 per cent solution of saponin, smilacin, and senegin. Longer treatments result in an increase of osmotic pressure. A change in the critical plasmolytic concentration of the salt employed for determining the osmotic pressure of a cell may mean either an increase or a decrease in permeability, depending upon the interpretation. It was possible to show by several different observations that a lower critical plasmolytic concentration means increased permeability in the case of saponin-treated cells. The saponins greatly stimulate the streaming of protoplasm.

The permeability and narcosis theories of Overton, Traube, Czapek, and Warburg are considered. It is claimed that each theory is supported by experimental evidence, but that none of them alone offers a complete explanation of all permeability phenomena.

Observations on the action of X-rays on plant cells, M. WILLIAMS (*Ann. Bot. [London]*, 37 (1923), No. 146, pp. 217-223).—Strips of tissue from the upper surface of the petiole of *Saxifraga umbrosa* were subjected to X-rays. Small doses accelerate circulation of the protoplasm, but a depression follows, with no return to the normal in 24 hours. Evidence appears of a lowering of the viscosity of the protoplasm during the early stages of radiation, this change being irreversible from the time it becomes visible. There is no direct influence of the rays upon the anthocyanin or the chlorophyll. The protoplasm permits the diffusion of solutes from the vacuole and appears to become coagulated. By the time a precipitate can be obtained with the potassium dichromate used as a test for increased permeability all movement of the protoplasm has stopped.

Experiments on the growth of fungi on culture media, W. BROWN (*Ann. Bot. [London]*, 37 (1923), No. 145, pp. 105-129, figs. 7).—The experiments described in the present paper had their origin in certain unexplained results met with in an investigation (E. S. R., 48, p. 844) of the growth of fungi in atmospheres of different composition. It was there found, with cultures of *Botrytis cinerea* and *Alternaria grossulariae* on a variety of media, that the effect of moderate concentrations, 10 to 20 per cent, of carbon dioxide consisted in general in a reduction of growth as measured in terms of the diameter of the colony. On the other hand, with cultures of *Sphaeropsis malorum* on certain media, the colony growing in 10 per cent carbon dioxide at first lagged behind the one growing in air, but later on surpassed it. With a view to a better understanding of such behavior the present study was undertaken. The aim of the investigation has developed into the study of the form of fungus cultures, chiefly in its relation to external factors. Considerable progress has been made in a number of directions, and the author believes it possible by work along these lines to attack two large problems of fungus physiology. One of these is the problem of strains, the second that of the suitability of a particular nutrient for a given fungus.

The present paper deals with the so-called staling of fungus cultures. By a stale culture is meant one which has practically ceased growing. A stale medium means one which, through the growth of an organism, has been rendered practically useless for the same or other organism. Staling substances or products are thus metabolic products of the organism which are responsible for slowing down or stopping growth. The fungi dealt with mainly were *S. malorum* and a *Fusarium* species, both of which show well-defined staling phenomena.

Curves of growth rate, as measured in terms of the diameter of the colony, are given for a number of fungi. In the early stages the rate of growth is small, afterwards it rises to a maximum which may or may not be maintained.

The growth of *S. malorum* and of *Fusarium* sp. on potato agar (which is of the staling type) has been studied in detail. It has been found that the relative amount of staling can be modified by changing the experimental conditions, by varying the depth of the medium, and in particular by the arrangements for disposing of two volatile products of the metabolism of the fungus, carbon dioxide and ammonia. According as the one or the other is allowed to accumulate, the greater or less degree of staling will result. The amounts of ammonia formed in *Sphaeropsis* cultures on a number of media are determined. Correlations between staling and sporulation and between staling and the phenomena of intermingling are indicated.

On the apical growth of fungal hyphae, J. H. SMITH (*Ann. Bot. [London]*, 37 (1923), No. 146, pp. 341-343).—Records of two experiments are given as

examples dealing with fungi representative of widely separated genera, in all of which it is found that the growth in length is purely apical, no appreciable elongation occurring in any part of the hypha other than the tip. This then would seem to be the general rule for fungi, though exceptions may perhaps occur. It may be contrasted with what occurs in filamentous bacteria, where each of the segments expands equally at the same rate, and in algae, where both types of growth occur, the purely apical and the intercalary.

Growth studies.—III, A "volumometer" method of measuring the growth of roots, J. H. PRIESTLEY and W. H. PEARSALL (*Ann. Bot. [London]*, 36 (1922), No. 144, pp. 485-488, fig. 1).—An apparatus for measuring the volume of roots at different stages of growth is described. The essential idea involved in this apparatus was that roots should remain in a fixed position in some container which would allow of their being grown under suitable conditions for a comparatively lengthy period. The container had, therefore, to provide for the accurate measurement of small volumes, and yet had also to be of considerable size to permit extensive root development. In addition, it had to be provided with a means of renewing the nutrient solution.

Observations lasting over a month included not only readings when growth was practically complete, but also the temporary cessation of growth following the development of lateral roots. During normal bean root development, volume changes of the order of 0.2 to 0.6 cc. for each two days are to be expected after the appearance of secondary roots. The earlier stages of root growth are probably observed better by direct measurements of length, as in experiments indicated as carried out by others.

The main results obtained by the authors in this work are said to be reproducible, the growth curves of individual plants being of the same general type. Previous papers of the series have been noted (E. S. R., 48, p. 726).

Studies in growth.—IV, Correlations in development, W. H. PEARSALL (*Ann. Bot. [London]*, 37 (1923), No. 146, pp. 261-275 figs. 6).—Data are here presented for the growth of roots from seeds, measured as changes of volume and of weight. The evidence shows that the development of subordinate roots upon roots of seedlings causes a temporary decrease in growth rate. The increase in the size of the root meristems after secondary root production appears to produce no corresponding increase in the growth rate of the whole root. The stem continues to grow after root growth has stopped. The observed facts are consistent with the hypothesis previously developed that food supply is a limiting factor in the early periods of root growth from seeds and cuttings. The stem is assumed to compete successfully with the root for the cotyledonary food supply, especially after the development of secondary roots, thus causing a reduction of the root growth rate.

It is claimed from results shown that in cotton the decreased rate of growth of the stem can be attributed to flowering, and that subsequently the decreased flowering rate can be attributed to the development of fruits nearer the source of supply of the presumed limiting food factors.

The conduction of geotropic excitation in roots, R. SNOW (*Ann. Bot. [London]*, 37 (1923), No. 145, pp. 43-53, figs. 4).—If decapitated root tips of *Vicia faba* are stuck in place again with gelatin, the roots usually bend in response to gravity as do normal roots, the excitation apparently passing through the gelatin. Neither the upper nor the lower side of the root can alone convey the excitation, nor can it be conveyed by a sinuous path. These findings are discussed.

Experiments on resistance of apple roots to low temperatures, G. F. POTTER (*New Hampshire Sta. Tech. Bul.* 27 (1924), pp. 34, figs. 2).—The results are given of a series of experiments begun at the Wisconsin and continued at the New Hampshire Station, in which not less than 15,000 apple seedlings were subjected to artificial freezing, and the effects on the roots were determined by microscopical and other examinations. All the roots were subjected to controlled temperatures and rates of cooling. After freezing they were stored in a cool cellar for several weeks before examination.

The tissues of the root system of the apple are said to be relatively tender, but serious winter injury does not occur frequently because it is only under severe climatic conditions, or when there is a lack of snow or other protective covering on the soil that critical soil temperatures occur. It is claimed that injury appears first as a browning of the immature xylem cells just within the cambium layer. The immature phloem cells are next in order of tenderness, followed by wood rays, cambium, phloem, and cortex.

An injury which discolors but does not kill the tissue was found to retard the top growth of seedlings. The rate of thawing after exposure to a given temperature did not affect the injury resulting from low temperature, nor did the protection of the roots from oxygen in any way reduce the amount of injury. Drying roots by exposing them to the air until about 5 per cent of the total moisture was lost was found to reduce the injury approximately to one-half that suffered by turgid roots. Increasing the length of time that the roots were held at a given minimum temperature resulted in a small but significant increase in injury. Freezing the roots at -8° C. for one-half hour or less gave much more injury than freezing them slowly so that the same temperature was reached in from six to seven hours.

The tip of the root was found to be more tender than portions near the crown, but among the roots of the same age small individuals were no more tender than large ones. Scions of varieties of different hardiness were not found to influence the hardiness of stock roots which were grafted under them. Scion roots from the more hardy varieties were more resistant to cold than stock roots of the same age and size.

It was found that if the same minimum temperature was reached, roots in moist soil were injured by freezing as much or more than roots in dry soil. However, moist soil is not ordinarily as cold as dry soil.

The healing of wounds in potato tubers and their propagation by cut sets, J. H. PRIESTLEY and L. M. WOFFENDEN (*Ann. Appl. Biol.*, 10 (1923), No. 1, pp. 96-115, figs. 3).—The methods by which cut surfaces of potato tubers heal over so that the tissues within are again protected from excessive evaporation and the entry of pathogenic organisms have been made the subject of investigation, and the sequence of events during the progress of healing is carefully traced.

"Apart from unessential color changes, the first process in the healing of the tuber is the deposit of a fatty 'suberin' layer formed by the oxidation and condensation of fatty substances depositing from the sap drying up in the tissues at the cut surface. The condition essential to the formation of this layer is access of oxygen. If the cut surface is exposed in a moist atmosphere the layer is continuous; in a dry atmosphere, especially in sunlight, the layer may not be continuous. This layer forms within 24 to 48 hours. A few days later cork is formed below this suberin deposit as the result of cell divisions in an actively dividing layer, the cork phellogen.

"The essential factors promoting the activity of this phellogen appear to be the accumulation behind the blocked surface of sap containing substances diffusing from the vascular bundles, and the production of an acid reaction

just below the blocked surface by the anaerobic conversion of sugars into fatty acids. The activity of the cork phellogen may be roughly estimated by the number of layers of cork produced. Comparative data are presented for a number of varieties of potato which show that Majestic, King Edward VII, and Bishop are particularly deficient in this important activity connected with the healing of wounds.

"The bearing of these facts as to the process of wound healing is considered in relation to the practice of propagation by potato sets and two practical conclusions drawn: (1) Potato tubers should not be cut in sunlight or left in too dry a place; (2) the practice of liming potato sets appears to be without justification so far as its use in promoting the healing of the wound is concerned."

Isolation of an inhibitory substance from plants, W. L. MALLMANN and C. HEMSTREET (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 6, pp. 599-602).—The occurrence of lytic and inhibitory substances from animal sources led the authors to make a study of diseased plants in order to determine whether or not such substances were found in association with plant pathogens. Soft rot of cabbage was selected for study, and an inhibitory substance was isolated from a rotten cabbage that was active on an organism obtained from the same cabbage. This substance became active against other soft rot-producing organisms, but the activity was lost by further transplanting. The inhibitory substance was not destroyed at 56° C. for 20 minutes but was destroyed at 63° for 30 minutes, showing a sensitiveness to heat comparable to micro-organisms and lytic substance isolated from animal sources. The inhibitory substance was present in extremely large amounts, as was indicated by its activity in high dilution. It is consequently not considered a toxic product of the organism.

Age and area: A reply to criticism, with further evidence, J. C. WILLIS (*Ann. Bot. [London]*, 37 (1923), No. 146, pp. 193-215, figs. 5).—This paper is concerned chiefly with a reply to the criticisms upon the age and area theory that were made at the Hull meeting of the British Association, and special attention is herein directed to the most fruitful sources of difficulty. The law is applicable only to groups of at least 10 allied forms. Several original pieces of work illustrate these points. Statistics are given of various British floras published from 1782 to 1908, and it is shown that the curves for sizes of genera for 10 floras of this period agree very closely. A correction is added to previous work upon the flora of Ceylon.

GENETICS

The somatic chromosomes of the chick and their possible sex relations, R. T. HANCE (*Science*, 59 (1924), No. 1532, pp. 424, 425, figs. 3).—Confirmatory evidence of the presence of two X-chromosomes in the somatic cells of male chicks and one X-chromosome in the somatic cells of females has been obtained in cytological studies at the University of Pennsylvania.

The form of spotting of the Argentine horse [trans. title], H. KRIEG (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 34 (1924), No. 1-2, pp. 134-139, figs. 6).—Based on a study of the spotting of a large number of Argentine horses, two distinct types have been observed which may vary greatly in amount. Type A has a center of white spotting on the croup, one on the side which extends up over the neck and may include the entire neck and thorax, a white blaze on the nose, and white feet. The white spotting originating from these centers may be so extensive that the spots may run in together, with color remaining only on the flank, and sides of the head. Type B spotting usually has a greater area of color than type A, the white being more on the

under portion of the body and flank. The feet are mostly white and the face is blazed.

The relation between chromosome number, morphological characters, and rust resistance in segregates of partially sterile wheat hybrids, K. SAX (*Genetics*, 8 (1923), No. 4, pp. 301-321, fig. 1).—Previous investigation (E. S. R., 46, p. 430; 48, p. 433) has shown that the cultivated species of wheat may be divided into three groups according to their taxonomic, sterility, and cytological relationships. These groups are delimited and further dealt with as studied subsequently.

“There is a striking correlation between chromosome number and morphological and physiological characters in the cultivated species of wheat. With an increase in chromosome number, . . . there is an increase in variability and adaptability, an increased susceptibility to rust, mildew, and bunt, a better quality of gluten in the grain, and the economic value is greater. The relation between chromosome number and morphological and physiological characters may be attributed to the greater opportunity for mutations to occur in species with the larger chromosome number, to a greater number of possible combinations in fertile hybrids, and to the cumulative effect of reduplicated factors or the combined effect of many different factors. The resistance to rust appears to depend on the physiological condition of the host. This condition may depend on a single hereditary factor in some varietal crosses, but in species hybrids many factors, acting either directly or indirectly, may influence the physiological balance which determines resistance or susceptibility. Rust and bunt resistance apparently depends on the same factors, so that results in breeding wheats resistant to rust can be applied to bunt, and vice versa. Pollen-grain size may be used as an approximate measure of chromosome number in wheat species and hybrid segregates. The breeding of wheat varieties to combine disease resistance with high yield and quality of grain is much more likely to be successful if the parents are selected within the [*T.*] *vulgare* group.”

A study of dwarfness in wheat accompanied by unexpected ratios, L. R. WALDRON (*Genetics*, 9 (1924), No. 3, pp. 212-246, fig. 1).—Dwarf plants appeared in hybrid families derived from crosses made at the North Dakota Experiment Station between Kota and certain rust-susceptible varieties of wheat. The F_1 individual was of normal height. In one series of Marquis \times Kota, the F_2 generation had families with the following ratios of normal to dwarf plants: 1:0, 3:1, 13:3, 55:9, 15:1, and 63:1. One of the dwarf plants of this series of the F_2 generation produced families in the F_4 generation, with ratios of normal to dwarf plants as follows: 1:0, 0:1, 1:3, 7:9, 1:15, and 1:63. In addition an aberrant ratio of $1:29\pm$ appeared.

To account for a genotype of the F_1 generation producing the various ratios which resulted, it is suggested that a factor, N, is present for normal height dominant over other genotypic conditions. Two additional factors would be assumed, A and D, activating and dwarf, resulting in dwarfness when both are present in the absence of dominant N. From this, 55 normals to 9 dwarfs should result in the F_2 generation. In the F_3 generation normal and dwarf plants should produce families of normals to dwarfs in the following ratios: 1:0, 3:1, 13:3, 55:9, 1:3, 7:9, and 0:1. These ratios and also the others indicated above were obtained. The author suggests that the facts may be accounted for by assuming in connection with the foregoing hypothesis, that certain of the genotypes ordinarily producing plants of normal height become so modified that genes for dwarfness are changed to genes for normal, and vice versa.

The factor for bitterness in the sweet almond, M. J. HEPNER (*Genetics*, 8 (1923), No. 4, pp. 390, 391).—With the hope of improving present almond varieties or securing new ones that would bloom late and yet be good in quality and productivity, a large number of nuts were secured from the crosses made in the first (1916) and fourth (1919) years of an almond pollination experiment being carried on by the California Experiment Station, and developed into seedlings. The first year's planting consisted of 602 trees resulting from 32 crosses. Of these trees 243 came into bearing in 1922, comprising practically all the trees in 21 crosses. Out of the 243 trees there are 59 with bitter almonds and 208 with sweet almonds, distributed among the various crosses, and with no uniform outstanding proportion between trees possessing sweet almonds and those possessing bitter almonds in all the crosses.

"As far as their genetic constitution for bitterness and sweetness is concerned, it seems likely that all varieties of sweet almonds are hybrids. . . . It is possible that a mutation occurred in the bitter almond tree with the sweet almond as the result. This probably accounts for the two general types or races of almonds existing to-day, namely, the bitter and the sweet. Such a mutation is of more than ordinary interest because the mutant character is dominant to the normal wild type, and because this mutant character consists in the loss of the bitter principle present in the wild progenitor.

Inheritance of egg size in *Drosophila melanogaster*, D. C. WARREN (*Genetics*, 9 (1924), No. 1, pp. 41-69, figs. 14).—The results of a study of the inheritance of egg length in different mutant stocks of *D. melanogaster* are reported from the Kansas Agricultural College. The range in the variation of egg length is tabulated for 26 mutant stocks, and it is shown that certain stocks differ so widely in this respect that there is very little overlapping between the extremes of each.

A preliminary study of the effect of various factors on egg size was made preceding the study of inheritance, and it was found that egg size is not influenced by the size of the females, moisture conditions, or temperature. Small females were, however, found to lay less eggs. The eggs of two females were found to decrease slightly with age, but this was not the case with a third female. Daily fluctuations were observed in the size of the eggs of individual flies, but the cause of this variation was not determined.

In studying the mode of inheritance of egg size, crosses were made between the mutant stocks abrupt and bar showing the greatest average difference in egg length, 29 units for the former and 24.7 units for the latter (1 unit equals 0.018 mm.). Crosses were also made between apricot-vermilion-forked stock, of which the eggs averaged 28.5 units in length, and ruby stock, in which the eggs averaged 25.4 units.

The results of these crosses indicated that the long eggs of the abrupt stock are due to several factors, but that a main one is located in the sex chromosome and another important one is located in the third chromosome group. Either one of these factors may produce long eggs in the absence of the other. A minor modifying factor for long eggs is probably located in the second chromosome group. There appears to be one or more genes determining the shortness of the eggs of bar stock which are located in the second chromosome, and which may produce its full effect in the homozygous condition even in the presence of the sex-linked long factor in a heterozygous condition. The existence of a modifier for short egg length located in the third chromosome was also suggested.

The long eggs of the apricot-vermilion-forked stock are apparently determined by the same sex-linked gene as was found in the abrupt stock and in addition

one or more genes located in the fourth chromosome, but the second and third chromosome modifiers of the abrupt stock were not found. The length of the eggs of the ruby stock was reduced practically to that of bar by 10 generations of selection, and it is assumed that the same factors determine shortness in the ruby stock as in the bar stock except that additional modifiers are present in the ruby stock which were removed by selection.

It was found in the experiments that the general tendency in egg size was for F_1 s to be intermediate between the two parents.

Pericarp studies in maize.—I, *The inheritance of pericarp colors*, E. G. ANDERSON and R. A. EMERSON (*Genetics*, 8 (1923), No. 5, pp. 466-476).—"The pericarp colors which are of most frequent occurrence in North American maize can be divided into two strikingly different categories:

"(1) A series of allelomorphic or closely linked types characterized by a rather insoluble brick-red or orange-red pigment. These types differ among themselves chiefly in the amount and distribution of this pigment. The brick-red pigment is replaced by a yellowish one when the factor a is homozygous, the distribution and relative intensity remaining the same. The red pericarp pigment develops on sun-red, dilute-sun-red, purple, and dilute-purple plants, and the brown pericarp pigment on brown and green plants. The characteristic factor P is independent of A , R , and P_1 , and is linked with the factors for brachytic culm, tassel seed, and fine-striped leaf.

"(2) Cherry pericarp color, due to the presence in the pericarp of the water-soluble purple pigment (anthocyanin) found commonly in the sheaths, leaves, anthers, aleurone, etc. Its development is determined by two dominant factors, the factor r^{ch} and the purpling factor P_1 for plant color. The purple pigment is replaced by a yellowish pigment when the factor a is homozygous. Since dominant P_1 is required for the production of cherry pericarp color, it can not occur on sun-red or dilute-sun-red plants. The factor r^{ch} is one member of the R series of allelomorphs for aleurone and plant color and is consequently linked with the factors for golden leaf and luteus seedlings. It is independent of P , P_1 , and A . The factor P_1 is independent of R , P , and A , and is linked with the factors for yellow endosperm and salmon silks."

The interaction of factors in the production of pericarp color in the two series is presented as a red series and a cherry series.

The Japanese rabbit and gametic purity, W. E. CASTLE (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 6, pp. 222-224).—The author suggests that the factor for Japanese pattern (yellow mottled with black) in rabbits behaves as a mosaic between the allelomorphs E^D (dominant black) and e (yellow), since the yellow portions of the coat are white ventrally and clear yellow dorsally as with the presence of the agouti factor, but the black hairs are solid black and appear as in the absence of the agouti factor. It is suggested that the mosaic type of gene has probably arisen from imperfect segregation in a heterozygote between dominant black and yellow and has remained very stable. It is further stated that for simplicity of description the probable mosaic origin may be ignored and it may be regarded as a fourth allelomorph of the yellow series designated as e^J .

Experiments and observations on inheritance in swine [trans. title]. C. KRONACHER (*Ztschr. Induktive Abstam. u. Vererbungslehre*, 34 (1924), No. 1-2, pp. 1-120, figs. 66).—The results of experiments conducted at several places in Germany in crossing various breeds of swine for the study of the mode of inheritance of colors, pattern, and body form are reported. Included in the breeds crossed for these experiments were the following: Improved Native German Landschwein, Half-Red Bavarian Landschwein, White Ger-

man Edelschwein, Hannov-Braunschweigschen Landschwein (black and white), English Large Black pigs, and Berkshires.

In analyzing the color experiments, it was found that uniform colors were generally dominant to broken colors, but this was not universal. The following major factors for determining colors were suggested: R and S, two factors for white, found usually homozygous in Edelschwein and improved Landschwein. The homozygous recessives of each caused red and black, respectively, either predominating over the dominant of the other. Another factor, N, determines dominant black as in the English Large Black. In the presence of dominant white a bluish color results. Evidence of incomplete dominance of the three color factors in the heterozygous condition was also found. Much variation in the hereditary behavior of markings, stripes, and other quantitative conditions of color was observed, the indications being toward an hereditary control, but the mode of operation of definite factors was not determined.

The inheritance of body and head form was studied in the crosses, and in general the F_1 generations were intermediate between the two parents. The inheritance of ear type was also apparently controlled by several interacting factors. Lopped ears were usually dominant to erect ears, though more than one factor was probably operative. The bell-shaped ear, which was observed in some of the pigs used, was dominant to the normal, though incompletely in some cases. The author believes that the close inbreeding practiced in the production of F_2 and F_3 generations tended to reduce the vigor of the pigs produced, as many did not grow normally. Using one mule-footed pig, it was found that this character behaved as a dominant in the F_1 .

In the general discussion of the conclusions to be derived from the work, the part played by environment in determination of such characters as fertility and body form is discussed, and emphasis is given to the importance of future study along this line.

The genetic relation between *Triticum dicoccum dicoccoides* and a similar morphological type produced synthetically, H. H. LOVE and W. T. CRAIG (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 515-520, pls. 8).—To compare the genetic behavior of *T. dicoccum dicoccoides* (E. S. R., 23, p. 533), and a phenotypically similar synthetic form (E. S. R., 41, p. 338), they were crossed with Kubanka durum wheat and with Black Winter emmer at the New York Cornell Experiment Station. The F_1 plants from the two crosses with Kubanka were quite similar, and those from crossing the two wild types with Black Winter emmer were alike in each case. Studies of the F_2 generation showed the synthetic wild and the true wild to be similar in inheritance of the character of the rachis, head type, and color of glumes and of kernel, indicating that the two forms are also genetically alike.

“Hairy neck” wheat segregates from wheat-rye hybrids, C. E. LEIGHTY and J. W. TAYLOR (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 567-576, pls. 5).—The hairy neck found in wheat-like segregates of wheat-rye hybrids appears to be a heritable character, but the limited data do not permit definite conclusions regarding the number of factors involved or the manner of their transmission. Considerable irregularity in segregation is apparent, and both dominant and recessive tendencies are observed. The behavior may be related to probable irregularities in chromosome behavior. The hairy neck character dealt with in this contribution from the Bureau of Plant Industry, U. S. D. A., is an example of a definite rye character present in individuals of the F_2 generation, traceable to the original rye parent, the parent with the lesser number of chromosomes. In other respects the hairy neck

selections resemble wheat, and exhibit very little sterility. Previously reported segregates of wheat-rye hybrids nearly always reverted rapidly to wheat, but the results reported here suggest that plants combining certain characters of the wheat and rye parents can be obtained.

FIELD CROPS

[Forage crops investigations in Florida], W. E. STOKES (*Florida Sta. Rpt. 1923*, pp. 31-45, figs. 7).—Variety tests with sorgos and sorghums, peanuts, velvet beans, and oats, and legumes for hay; fertilizer tests with peanuts and sweet potatoes; breeding work with Spanish peanuts, Merker grass, and Napier grass; and studies of pasture and lawn grasses are reported on, supplementing previous work (E. S. R., 49, p. 823). The behavior of molasses grass, jaragua grass (*Andropogon rufus*), Dallis grass, Vasey grass, Hubam sweet clover, subterranean clover, serradella, *Crotalaria* sp. (including analyses), and newly introduced forage plants is commented on briefly.

Brabham cowpeas outyielded mungo beans, soy beans, and bush velvet beans for hay on Norfolk sand of low fertility. Unfertilized Napier grass gave 58 and 200 per cent better results than the highest yielding, liberally fertilized sorghum and silage corn, respectively. Both Napier grass and Japanese cane responded strikingly to irrigation with overflow from septic tanks. Comparative yields showed that the large varieties of sorgo with medium to late maturity could be expected to give the best returns for soiling and silage, whereas the smaller stemmed earlier varieties are more satisfactory for hay in combination with cowpeas.

Where Spanish peanuts were grown in rotation with corn and velvet beans during five years and the peanuts variously fertilized and then half of each plat treated with ground limestone at the rate of 1 ton per acre, the lime decreased the yield of nuts and hay. Nitrogen and potassium appeared to be limiting elements in the profitable production of sweet potatoes on Norfolk sand of from poor to medium fertility, best results being obtained from a complete fertilizer. No marked residual effect of any of the fertilizer treatments was noted on the yield of peanuts planted after the sweet potatoes.

Seed of Bahia grass from Costa Rica and Cuba generally germinated better than Florida seed, and better germination was had during June, July, and August than from either spring or fall seedings. Seed sown on prepared land germinated better, on the average, than that sown on unprepared lands, and seed lightly covered usually germinated better than seed not covered, on either prepared or unprepared land. When Italian rye grass, redtop, and white clover were fall seeded across lawn grass plats, the fall sown grasses grew well during the fall, winter, and early spring, affording green lawns in winter when some of the southern grasses were browned by frost, but tended to retard spring growth of the southern grasses, this tendency being less pronounced with St. Augustine, centipede, Bahia, and the Bermuda grasses.

[Field crops work at the Georgia Coastal Plain Station, 1922 and 1923], (*Georgia Coastal Plain Sta. Buls. 3* (1923), pp. 8-13, 14, 16-18; 4 (1924), pp. 8-28, 34, 35, 39-42, figs. 5).—These pages report the continuation of experiments made earlier (E. S. R., 48, pp. 128, 628). Variety tests during several years showed as outstanding: Georgia Red wheat; Hundred Bushel, Appler, and Fulghum oats; Petty Toole, Lightning Express, and Cleveland strains of cotton; Whatley, Marlboro, and Hastings prolific corn varieties; North Carolina and White Spanish peanuts; Laredo, Otootan, and Southern Prolific soy beans; barnyard millet; Tracy Early Black velvet bean; Grey Winter

field peas; *Monanthos vetch*; *Medicago rigidula* (0373); Hardshell and York Yam sweet potatoes; and Green Mountain potatoes. Abruzzi and South Georgia rye have given about equal yields per acre. The barleys gave promise as grazing crops rather than for grain in south Georgia. Experiments with tobacco and grasses and pastures in cooperation with the Georgia College of Agriculture and the U. S. Department of Agriculture are described briefly.

Seeding experiments suggested a 6-pk. rate with wheat and from 8 to 10 pk. about November 1 with oats. February 1 seemed to be the best time to apply nitrogenous top-dressings to oats. Applications of 400 lbs. of 16 per cent acid phosphate at the time of seeding and either 80 lbs. of ammonium sulfate or 100 lbs. of sodium nitrate as top-dressing were found beneficial. A small application of potash appeared to prevent lodging and seemed desirable on light sandy soils.

Varieties of cotton characterized by wilt resistance, earliness, sizable bolls, continuous fruiting throughout the season, and a good length and percentage of lint made the best in yields. Nitrogen applied in both organic and inorganic forms seemed to produce better yields of cotton than when derived from a single source. Maximum yields of cotton were made on an area poisoned with a home mixture of 1 gal. table sirup, 3 gal. of water, and 3 lbs. calcium arsenate applied throughout the season with a hand mop, and at a low cost as compared with cotton poisoned with Hill's mixture and calcium arsenate dust. The Florida method was lowest in cost and apparently in effectiveness. The results suggest applying the home mixture first just before the squares appear and at 7 or 10 day intervals, depending on the weather, until the first blooms appear. Afterwards calcium arsenate dust should be used whenever required to control the weevil.

Corn with a close fitting, fine textured husk extending well over the tip of the ear was observed to offer the greatest resistance to corn weevil. Varieties with loose, open, coarse textured husks revealing the ear tip have been invariably damaged in the field by weevil. Application of complete fertilizer when corn was from 18 to 20 in. high gave better returns than when made at planting. Profitable increases with peanuts followed acre applications of about 250 lbs. acid phosphate or 1,600 lbs. of hydrated lime or the equivalent of 3,000 lbs. of ground limestone.

Larger yields of hay appeared obtainable from some soy bean varieties than from cowpeas. Soy bean seed can be produced, whereas satisfactory yields of cowpea seed are seldom had in southern Georgia.

Very little difference was noted with potatoes receiving overhead or subirrigation. Early plantings and late harvests have produced the highest yields of sweet potatoes. Close spacing (4 in.) gave maximum yields in a favorable season, whereas when drought occurred in September and October, 16 in. produced the most No. 1 tubers. Northern grown sweet potato seed stock showed no marked advantage in yields over southern grown seed stock.

The tobacco investigations have shown the response to applications of acid phosphate on new land and the almost complete failure of all crops on new land fertilized with nitrogen and potassium but omitting acid phosphate, the effect of withholding potash from tobacco fertilizer resulting in potassium starvation and breakdown of the plant, the beneficial effect of stable manure on growth and quality of tobacco extending beyond the plant food in the manure, and the considerable net increase in the returns from tobacco from heavy as compared with medium or light applications of commercial fertilizer. The use of nitrogen from several sources appeared better than depending entirely on one source.

[Agronomic experiments in Guam, 1922], J. GUERRERO (*Guam Sta. Rpt. 1922*, pp. 7-14 pls. 2).—As in the previous report (E. S. R., 49, p. 426), yields and other agronomic data are tabulated from the results of varietal trials with grain sorghums, sorgos, small beans, velvet beans, soy beans, cowpeas, pigeon peas, miscellaneous legumes, cassava, and sugar cane.

Besides Paspalum and Para grasses, Napier grass, Guatemala grass, and Japanese cane seem well adapted to island conditions. Para grass intercropped with cowpeas and *Crotalaria juncea* gave only a slight increase in forage yield over the grass alone. Cuttings of Para set in holes in an area of *Andropogon aciculatus* could not compete in any degree with the native grass. Further observations on the pastures of the Cotot district showed overgrazed Para to be replaced by *Ageratum conyzoides* and *Hyptis capitata*, and these in turn to be supplanted by native grasses. Notes on the merits of Rhodes grass, pearl millet, and teosinte are included.

Pigeon peas, patani beans, and *C. juncea* in the order named, were the most efficient of the cover crops grown. When sown on heavy clay loam pigeon peas withstood excessive rainfall much better than velvet beans, cowpeas, and *C. juncea*.

Rice receiving ammonium sulfate and acid phosphate gave the highest yields of clean paddy, and that receiving ammonium sulfate alone produced the most straw.

White and yellow cassava grown from whole stalks produced 67 and 33 per cent, respectively, more roots than when grown from cuttings.

[Crop variety tests on the Soils and Crops Experiment Farm] (*Indiana Sta., Soils and Crops Expt. Farm, Summary, 1915-1923*, pp. [6-8], fig. 1).—Tabulations show that the highest average acre yields during different periods were produced by Dunfield, Aksarben, and AK soy beans for feed, Lexington and Arlington soy beans for hay; Purkoff, Rudy, and Michigan Amber winter wheat; Mammoth and Petkus winter rye; Purdue No. 21 winter barley, Manchuria and Black Barless spring barley; and Minota and Victory oats.

[Crop tests at the Moses Fell Annex Farm], H. J. REED and E. W. MOORE (*Indiana Sta., Moses Fell Annex Rpt., 1923*, pp. 9-12, fig. 1).—Varietal leaders to date have included the large strains of Johnson County White and Reid Yellow Dent corn, Red Rock and Michigan Amber wheat, Midwest and Dunfield soy beans, and Iowa 103 and Swedish Select oats. Seedings on wheat and rye of 8 lbs. of clover per acre made from Feb. 15 to Mar. 15 and seeding of 4 lbs. in February and 4 lbs. about April 1 have given the best results.

[Field crops work in Mississippi, 1923], J. F. O'KELLY, R. COWART, C. T. AMES, and W. E. AYRES (*Mississippi Sta. Rpt. 1923*, pp. 8-10, 11, 12, 51, 52, 56-60).—The progress of previous work at the station (E. S. R., 49, p. 428) is reported on, with summary accounts of experiments at the Holly Springs (E. S. R., 50, p. 828) and Delta (E. S. R., 51, p. 134) Substations, already noted elsewhere.

Corn selected for long husks yielded slightly more per plat than seed from short-husk selections, and long-shank seed outyielded short-shank selections. Cultural tests with corn seem to suggest 2-ft. spacing in 3.5-ft. rows with about 4 cultivations, preferably deep. Improved strains of Trice, Miller, Lone Star, and Cleveland cotton (E. S. R., 50, p. 735) are being carried forward. Varietal leaders included Ootootan, Laredo, and Barchet soy beans; Whippoorwill, Groit, and Iron cowpeas; and strains of Red Rustproof oats.

Report of the summer fallow substitute section committee on field experimentation, M. CHAMPLIN (*Sci. Agr.*, 4 (1924), No. 12 pp. 394-398).—This report, presented at the meeting of the Western Canadian Society of

Agronomy at Edmonton, Alta., in December, 1923, comprises the tabulated acre yields of wheat following fallow and fallow substitutes, including corn, potatoes, sunflowers, oats, barley, wheat, and Sudan grass; the yields of the substitutes, and estimated acre values. The comparisons were made at several stations in Alberta, Manitoba, and Saskatchewan.

[Field crops work in Tortola, British Virgin Islands, 1920-1923], F. WATTS (*West Indies Imp. Dept. Agr., Tortola Agr. Dept. Rpts., 1920-21, pp. 2, 3, 6-9; 1921-22 and 1922-23, pp. 3, 4, 6-22, 23-26*).—The continuation of experiments with field crops is described as heretofore (E. S. R., 46, p. 226).

[Field crops work in Aberdeen, Scotland] (*North of Scot. Col. Agr., Guide Expts. Craibstone, 1924, pp. 8-32, 34-37, fig. 1*).—The progress of experiments with field crops (E. S. R., 50, p. 433) at Craibstone farm near Aberdeen is described as heretofore.

[Report of the] Scottish Society for Research in Plant-Breeding, M. DRUMMOND (*Scot. Soc. Research Plant Breeding Rpt., 2 (1923), pp. 43*).—The continuation of plant breeding work noted earlier (E. S. R., 48, p. 434) is reported for 1922.

[Field crops work in the Central Provinces and Berar, India, 1922-23], J. C. McDUGALL, S. G. MUTKEKAR, J. H. RITCHIE, R. G. ALLAN, F. J. PLYMEN, ET AL. (*Cent. Provs. and Berar [India] Dept. Agr., Agr. Stas. South. Circle Rpt. 1923, pp. 2-6; West. Circle Rpt. 1923, pp. 2-5; East. Circle Rpt. 1923, pp. 1-13, 17-19; North. Circle Rpt. 1923, pp. 3-6, 7-10, 19-40, 64-67; Expt. Farm, Agr. Col., Nagpur, Rpt. 1923, pp. 2-18; Agr. Col., Nagpur, Bot., Chem., and Mycol. Research [etc.] Rpt. 1923, pp. 13-16; Cent. Provs. [India] Dept. Agr. Rpt., 1922-23, pp. 5-13*).—The progress of experiments with field crops is reviewed as heretofore (E. S. R., 50, p. 433).

Nomenclature of grasses and clovers, R. G. STAPLEDON (*Jour. Min. Agr. [Gt. Brit.], 31 (1924), No. 2, pp. 156-161*).—The author attempts to define such terms as nationality and strain, stock seed, wild or indigenous, and harvest year, as applied to grasses and clovers.

Corn selection for exhibit purposes, C. A. HELM (*Missouri Sta. Circ. 126 (1924), pp. 7, figs. 8*).—Instructions on how to select a sample of corn for seed or exhibit purposes are given briefly with appropriate illustrations.

A program of corn improvement, C. M. WOODWORTH (*Illinois Sta. Circ. 284 (1924), pp. 24, figs. 15*).—This circular, essentially a reprint of a section with the same title in Bulletin 255, noted on page 245, describes the merits and application of the selection and pure line methods of corn improvement.

Length of cotton fiber from bolls at different heights on the plant, T. H. KEARNEY and G. J. HARRISON (*Jour. Agr. Research [U. S.], 28 (1924), No. 6, pp. 563-565, fig. 1*).—The length of the fiber from bolls borne at different heights on the plant was determined on 10 plants of Pima Egyptian cotton grown under irrigation at Sacaton, Ariz. The plants did not differ significantly in mean length of fiber. Although the differences in mean fiber length as between any 2 successive groups of fruiting branches were not significant, a steady increase was observed from the lowest to the next to the highest group. Thus bolls borne on the lower fruiting branches, constituting the so-called "bottom crop," appeared to produce shorter fiber than bolls situated higher on the plant. A comparison of the mean length of Pima cotton fiber in bolls from flowers which had opened during successive periods in 1921 with the mean length from bolls borne at successive heights on the plant pointed to the conclusion that the length of fiber is affected less by the date of flowering than by the height on the plant of the fruiting branch on which the boll is borne.

The effect of treatment with sulphuric acid on the breaking load of cotton, P. D. VINCENT (*Brit Cotton Indus. Research Assoc., Shirley Inst.*

Mem., 3 (1924), No. 11, pp. 125-134, figs. 7; also in *Jour. Textile Inst.*, 15 (1924), No. 5, pp. T281-T290, figs. 7).—The effect of treatment with sulfuric acid of various concentrations at room temperature on the breaking load of cotton fibers and yarns was determined at Shirley Institute.

The strength of a single cotton fiber is decreased in direct proportion to the concentration of acid with which it is treated, and cotton is entirely disrupted by acid containing about 77 gm. of H_2SO_4 per 100 cc. A natural yarn break consists both of slipping and breaking of the component fibers, and this influences the effect of treatment upon the breaking load of yarn. The yarn strength at first diminishes slowly and in proportion, but more rapidly after a certain strength of acid is reached, although still in proportion to the concentration of the acid. The critical concentration in the case of American and Egyptian yarns is about 20 gm. per 100 cc. Kier boiling increases the breaking load of untreated yarn but still further weakens yarns treated with the weaker acid. This effect is also explained in the light of the nature of a yarn break.

Oil seed crops in Argentina [trans. title], E. F. PAULSEN (*Rev. Facult. Agron. y Vet. Buenos Aires*, 4 (1923), No. 2, pp. 397-440, figs. 8).—The production, characteristics, and commercial utilization of the principal oil crops in Argentina are discussed, with comment on the status of the vegetable oil industry in the country.

The annual extraction from about 15 mills is estimated to be about 18,000 tons, as compared with a normal demand of 30,000 tons. Suitable soils and climatic conditions exist in Argentina, and the quality of the oils extracted is said to compare favorably with that of oils produced in Europe and North America. The oils produced on large scale are, in order of importance, linseed oil, peanut oil, cottonseed oil, oil of *Brassica campestris*, olive oil, sunflower oil, castor oil, and thistle oil.

The floral parts of the potato as aids in the identification of varieties (*Scot. Jour. Agr.*, 7 (1924), No. 2, pp. 187-193, fig. 1).—The floral parts of the potato are discussed from the standpoints of differences in structure and in physiological processes connected with their development, varieties commonly grown in Great Britain being cited as examples. In comparing and identifying varieties, it is thought injudicious to overemphasize any individual floral character. The plants as a whole must be considered, and differences in the flower parts must always be studied in conjunction with the rest of the organisms.

Some factors affecting the value of potatoes for seed purposes, W. J. PROFEIT and W. M. FINDLAY (*Scot. Jour. Agr.*, 6 (1923), No. 1, pp. 54-63).—In potato investigations at Craibstone by the North of Scotland College of Agriculture, continued selection of small sets did not lead to any deterioration, nor did continued selection of large sets result in improvement. The proportion of small tubers from the small sets was no greater than from the large or medium sets. The crop from the medium sets tended to be the largest, and ripened slightly earlier than that from the large cut or small sets. No improvement was effected by continued selection of sets from large plants, and it is held that, so long as the plants are healthy, deterioration need not follow necessarily where sets from small plants are continuously used. The fertilizer treatment given the crop from which the seed was selected had no effect whatever on the productivity of the seed itself. The view that a variety or strain of potatoes will deteriorate simply because of age was not substantiated. No advantage as regards yield in using early harvested seed was obtained as compared with the late, and leaf roll and mosaic were found to be quite as prevalent in crops from the early lifted as from the late lifted sets.

Considering the experimental results as a whole, the authors conclude that "if a potato variety is kept pure and free from disease, and is grown under suitable soil and climatic conditions, there need be no deterioration. Further, selection inside the variety itself can effect no improvement as regards yield, quality, or disease-resisting powers."

The physiology of the germination of rice, the growth of seedlings, and the condition of the seed beds [trans. title], M. KONDŌ (*Ber. Ōhara Inst. Landw. Forsch.*, 2 (1923), No. 3, pp. 291-359, figs. 20).—The group of studies reported on deals with the absorption of water by seed rice before sowing, the germination of rice harvested at different stages of maturity (E. S. R., 42, p. 35), the temperature of the seed bed (E. S. R., 49, p. 632), and the germination of seed rice and the growth of seedlings on the seed bed (E. S. R., 49, p. 633). The principal conclusions are in agreement with those already recorded.

The length of time required for soaking seed rice to enhance germination when planted may be determined by considering the average length of the germination period at different temperatures. The time required for soaking appeared to be longer at lower temperatures than that needed for saturation, whereas the reverse was true at higher temperatures. Although soaking seed rice improved germination, it had no influence on the further growth of the seedlings.

The view that immature rice is better than fully ripened kernels for seed is considered without basis. At maturity is the best harvest time for seed rice, since mature seed germinates excellently and its seedlings show good subsequent growth. Immature kernels are useless for seed stock, as their germination is low and their seedlings are weak and develop slowly. Dead-ripe rice is held to be inferior to mature grain in every respect.

Experiments with rice [trans. title], M. MONTANARI and D. M. MATUS (*Rev. Facult. Agron. y Vet. Buenos Aires*, 4 (1923), No. 2, pp. 441-451).—Experiments with rice carried on at the University of Buenos Aires during various periods between 1906 and 1922 included variety, cultural, and fertilizer trials and seeding and irrigation tests.

The present position of sisal hemp cultivation, with special reference to the British Empire, E. GOULDING (*Bul. Imp. Inst. [London]*, 22 (1924), No. 1, pp. 39-55).—A brief account is given of the efforts made to establish sisal (*Agave sisalana*) cultivation within the British Empire, together with the present status and prospects of the industry in the countries in which the growth of the crop has been attempted.

The only British countries producing the fiber on an extensive scale at present are Kenya, Tanganyika, and the Bahamas, but commercial supplies may be expected soon from Ceylon, Nyasaland, Gold Coast, Mauritius, and Jamaica. Several other countries are well adapted to the crop and have extensive areas available for cultivation. The results of the attempts to develop a sisal hemp industry in these various countries have confirmed the view that the crop can not be profitably produced unless the operations are carried out on a large scale and with the employment of modern machinery.

The effect of cold on the buds of sugar cane [trans. title], G. L. FAWCETT (*Rev. Indus y Agr. Tucumán*, 14 (1923), No. 5-6, pp. 67-73).—Buds of P. O. J. 213 sugar cane were subjected to low temperatures at Tucumán. The temperature lethal to mature buds appeared to be about -3° C. (26.6° F.) Sprouts seem to be less resistant to cold, temperatures of -1.5 to -2° being fatal, depending on the stage of development. The black color of the interior of the young sprout appears to be produced by prolonged exposure to temperatures somewhat above that freezing the cane.

[A report on the results of work with wheat at Iredell (N. C.) branch farm, 1911-1921], C. B. WILLIAMS, W. F. PATE, F. T. MEACHAM, S. K. JACKSON, and H. B. MANN (*N. C. Dept. Agr. Bul.*, 1923, Nov., pp. 48, figs. 6).—Fertilizer experiments with wheat on red clay loam soil at the Iredell farm during the period indicated suggested the use of about 600 lbs. per acre of fertilizer containing from 10 to 12 per cent of available phosphoric acid, 5 per cent of nitrogen, and 1 per cent of potash for the production of wheat on average upland soils, similar to the one used in these tests, in the Piedmont section of North Carolina. Plowing into the soil suitable leguminous crops and crop residues is advised as a means to reduce the nitrogen in the fertilizer. Cultural methods and field practices are recommended for wheat production in the Piedmont region of North Carolina.

Experiments with wheat, G. L. SUTTON (*Jour. Dept. Agr. West. Aust.*, 2. ser., 1(1924), No. 2, pp. 209-228, figs. 9).—Rotation experiments carried on at the Chapman and Merredin Experiment Farms in Western Australia provided for continuous wheat, wheat after fallow with and without the intervention of a change or renovating crop, and wheat and fallow both alternating with change crops.

Oats were found desirable as a change crop for fodder and renovation, while rape and peas were too uncertain for general cultivation, although they gave better results after fallow than without. Fallowing appeared to be necessary in order to produce the surest, best, and cleanest crops on both light soil and fertile forest land with liberal and with light rainfall. While fertile forest soil showed no special need for the inclusion of a change crop, turning under crop residues would keep the land in condition. Including a change crop for renovating purposes in the rotation on light land distinctly enhanced wheat yields. Such crops should be fallowed. Deep plowing (8 in.) produced slightly better yields of wheat than medium (6 in.) or shallow (4 in.) plowing on light soil at Chapman, while at Merredin, on fertile forest soil, shallow plowing was quite as effective as deep.

Testing of New-Zealand-grown wheats, L. D. FOSTER (*New Zeal. Jour. Agr.*, 28 (1924), No. 6, pp. 401-405; 29 (1924), No. 4, pp. 254-259).—An additional series (E. S. R., 50, p. 438) of wheat samples harvested in 1923 and 1924 in different localities in New Zealand are reported on.

The samples of Velvet ranged from 70 to 73.1 per cent in flour yield, College Hunters 73.4 to 74.4, Tuscan 67.1 to 71.9, White Straw Tuscan 72.4 to 75.7, and Solid Straw Tuscan from 64.6 to 72.4 per cent. The few samples of Victor, Yeoman, Dreadnought, and Major gave from good to very good yields of flour. No very distinct differences were observed as regards the wheat-growing districts. The calculated weight per bushel of the samples tested did not appear to be generally correlated with the yield of flour.

Examination of the quality and baking value of the flours did not reveal among these samples a correlation between gluten content and calculated weight per bushel. Velvet retained its position as a wheat of good strength and the quality of the various Tuscan samples showed considerable improvement, generally averaging very good. Victor again gave very good yields of flour but of rather inferior strength. Yeoman did not appear to surpass in quality the average wheat grown in the Dominion. The average strength of the samples tested during 1924 was higher than that of the varieties tested the year before.

The best stage for cutting wheat, J. W. CALDER (*New Zeal. Jour. Agr.*, 28 (1924), No. 6, p. 400).—Further experiment at Canterbury Agricultural College, using College Hunters wheat, gave results confirming previous find-

ings (E. S. R., 50, p. 237) in regard to the optimum stage for cutting wheat.

Report of the Danish State Seed Control in its fifty-first year, 1921-22 [trans. title], K. DORPH-PETERSEN (*Tidsskr. Planteavl*, 28 (1922), No. 4, pp. 668-731, fig. 1).—The activities and finances of the Danish seed-control service are summarized along the lines of previous reports (E. S. R., 46, p. 37). For the year ended June 30, 1922, the number of seed samples examined was 23,424, of which 11,800 were sent in by seed dealers, 4,693 by seed growers, and 5,792 by farmers. It is reported that the seed collection of F. Nobbe, consisting of about 9,000 samples and specimens, was purchased during the year.

Perennial sow thistle: Growth and reproduction, O. A. STEVENS (*North Dakota Sta. Bul.* 181 (1924), pp. 44, figs. 28).—Extensive studies of the growth and reproduction of sow thistle (*Sonchus arvensis*) are reported, together with detailed consideration of its botanical relations, geographical distribution, vegetative and flowering habits, germination of fruits, and growth of seedlings. Control methods (E. S. R., 48, p. 36) are suggested briefly. The observations on the life history of the weed may be summarized as follows:

The fruits seldom if ever germinate at 68° F., but will germinate freely in from 4 to 7 days if exposed to 90° for a few hours daily. Seedlings do not establish themselves readily in bare soil, except where moisture conditions are favorable, whereas they can thrive in ground more or less covered with plant growth or old material. Seedlings begin to produce horizontal roots in less than 2 months from germination and may bear flowers in 3 months. Many of the seedlings appear to start during midsummer and, while not flowering the first season, become well established and develop both horizontal and vertical thickened roots.

Vegetative reproduction is by means of the vertical and horizontal thickened roots which are commonly about 0.2 in. in diameter, composed largely of parenchymatous storage tissue, and are very easily broken. The vertical roots may penetrate to a depth of a yard or more and can produce new aerial growth from 8- to 12-in. depths. The horizontal roots extend in all directions from the parent root, attaining lengths of from one to several yards during a single season. Pieces of the thickened roots 0.25 in. long can readily produce new plants which may flower within 3 months' time. Plants developing from buds on vertical roots below the depth of cultivation also may bear flowers during the season.

The main flowering period is from about July 1 to August 15, somewhat fewer flowering heads being produced until freezing weather by later developing plants or branches. Cross-pollination by insects seems necessary for abundant fruit development. The mature fruits, which germinate well as soon as mature, are set free in 10 days from the opening of the flower head. Although the fruits germinate very poorly or not at all if not over half mature when the plants are cut or pulled, viable fruits may be produced by heads flowering when the plants are cut, if the plants are piled so that the lower ones remain fresh for several days.

Mowing, to be effective in controlling the weed, should be repeated at least every three weeks from July 1 to frost, and the flowering stalks should be cut as soon as flowers open, since 5 or 6 days suffice to develop viable fruits. Where the land can be cultivated, repeated removal of the leaves by surface cultivation seems to be the most feasible means of eradication.

HORTICULTURE

How to collect, label, and pack living plant material for long-distance shipment, B. T. GALLOWAY (*U. S. Dept. Agr., Dept. Circ. 323 (1924), pp. 12, pls. 10*).—Suggestions and recommendations based on several years' observations and studies incident to the work of the Office of Foreign Seed and Plant Introduction are presented in order to insure the proper handling of plant material for long-distance shipments even under unfavorable environmental conditions.

[**Horticultural investigations at the Georgia Coastal Plain Station**] (*Georgia Coastal Plain Sta. Bul. 4 (1924), pp. 29-33, 35-38, figs. 3*).—A varietal study with tomatoes on wilt-free soil showed a strain known as Selection No. 5 to be most productive, both in respect to total and marketable yield, surpassing such well-known varieties as Livingston Globe, Earliana, Greater Baltimore, etc. Time of planting tests indicated that April is the most advantageous month in respect to yield of fruit. In a comparison of overhead and sub-irrigation, better results both in respect to yield and to the lesser amounts of water required were obtained with the former.

Watermelons planted previous to March 15 were more productive than later sowings. Watermelons sprayed with Bordeaux mixture yielded 550 fruits per acre as compared with 360 for control plants. The average weights were, respectively, 27.18 and 23.87 lbs. No benefit was obtained where spraying was discontinued before the end of the growing season. Variety tests with garden beans and strawberries are also briefly reported.

[**Horticultural investigations at the Guam Station**], J. GUERRERO (*Guam Sta. Rpt. 1922, pp. 15-18*).—As usual (*E. S. R.*, 49, p. 435), the report is confined largely to the results of miscellaneous fruit and vegetable tests.

Introduced orange trees bore fruits which failed to ripen properly, were very acid and fibrous, and decidedly inferior in quality to the better varieties of the so-called native orange. Ever-bearing strawberries, after yielding two crops of good quality, suffered severely from disease. Computations made at the completion of the pineapple fertilizer tests showed that ammonium sulfate used at the rate of 300 lbs. per acre was the most beneficial treatment in respect to yield, both with the Smooth Cayenne and the Thorny Red varieties. Data taken on plantings of crowns and suckers of three pineapple varieties showed that sucker plants not only came into bearing earlier than crown plants, but in most cases considerably outyielded the latter.

Coconut trees just coming into bearing showed no significant benefit from fertilization. In a test of various plants as cover crops for coconut trees, patani beans, closely followed by velvet beans, made the most effective cover both as regards density of growth and length of time the ground was covered.

[**Horticultural investigations at the Pennsylvania Station**] (*Pennsylvania Sta. Bul. 188 (1924), pp. 14, 21-24*).—This, the usual annual report (*E. S. R.*, 50, p. 439), is comprised of brief progress notes. Studies, by J. B. Hill, upon the progeny of reciprocal crosses between species of *Digitalis* showed that in most respects reciprocal species hybrids are identical and intermediate between parents. The obtaining of so-called sesqui-hybrids by crossing back a hybrid of *D. ambigua* \times *D. lanata* with the *D. ambigua* parent gave positive proof that *Digitalis* hybrids are not entirely sterile. Work with *Phlox drummondii*, by J. P. Kelly, indicated that the character for doubleness may be completely or incompletely recessive in different strains of singles. In a second hybrid generation one family gave a ratio of 1:14:1 for singles, intermediates, and doubles, respectively, indicating the probable existence of a pair of cumu-

lative multiple factors as the basis of doubleness. It is believed that factors acting as inhibitors for doubleness may also be present.

Observations by C. E. Myers indicated that the Penn State Ballhead, a promising cabbage variety developed by the station, has considerable resistance to blackleg. An examination of 672 second generation tomato plants resulting from a cross of Enormous X Yellow Pear indicated that two factors are concerned in the inheritance of plant type. It is thought that most of the characters considered, such as foliage texture and color, fruit clusters, and size and shape of fruits, are the result of the action of multiple factors. Determinations by W. B. Mack of the fertilizer requirements of tomatoes, cabbages, and early potatoes indicated that, when these crops are grown in a 4-year rotation including a cover crop, manure may be best applied to the potatoes and the tomatoes and commercial fertilizers to the cabbage.

As recorded by R. D. Anthony, the use of nitrate of soda upon sod-grown apple trees in the college orchard has resulted in increased fruit yields and improved growth in both grass and trees. From the yield viewpoint, applications of nitrate of soda at about the time the leaf buds were breaking were found most successful. Although the maximum yield was obtained from trees receiving two applications of 5 lbs. of nitrate of soda, the gain was only slightly larger than that resulting from the use of 5 lbs. applied early in the season. In a Franklin County orchard 10 lbs. of nitrate apparently approximated the optimum requirement. Discussing briefly the results of 15 years of fertilizer investigations, J. H. Waring reports that Pennsylvania apple orchards may be kept permanently and successfully in sod provided the resulting nitrogen deficiency is offset by early spring applications of nitrogenous fertilizers and that a heavy grass growth is secured and used as a mulch. The futility of applying fertilizers to well-tilled orchard soils in which the organic content is maintained by the use of cover crops was shown.

An attempt by F. N. Fagan to propagate apple and sweet cherry varieties by cuttings yielded, for the most part, negative results.

[**Horticultural investigations at Cheshunt, England**] (*Expt. and Research Sta., Cheshunt, Herts, Ann. Rpt., 9 (1923), pp. 8-65, pl. 1, figs. 2*).—In general continuation of glasshouse investigations (E. S. R., 49, p. 740), there are reported the results of miscellaneous fertilizer and variety tests. Attempts to sterilize glasshouse soils with formaldehyde were unsuccessful, there being considerable development of root fungus, *Colletotrichum tabificum*. Whether phosphates were supplied in the form of bone meal and flour or as basic slag apparently had little or no significance, the yields being approximately equal. Attempts to rebuild the fertility of soils from which phosphates, nitrogen, and potash had been withheld during the preceding six years gave interesting and somewhat inexplicable results. The addition of phosphate to the nonphosphate area resulted in reduced yields. Nitrogen added to the nonnitrogen and potassium to the nonpotassium areas not only increased yields, but decreased the amount of low grade, blotchy fruits far below that of the control plats.

That extra large applications of commercial fertilizer may be deleterious to the tomato was shown in much reduced yields on the overfertilized plats. Unmanured plats and those from which nitrogen, phosphoric acid, and potash had been withheld continuously were also low yielders. A comparison of the yield and quality of fruits on plats receiving top-dressing alone, base-dressing alone, and a combination of the two gave inconclusive results.

Analysis by R. A. Fisher, of the Rothamsted Experimental Station, of the yields of 34 small plats in a single glasshouse resulted in the conclusion that, if plats of small size are grouped in sets of 8 and the average considered, a

difference greater than 5 per cent may be regarded as significant. In a test of 12 tomato varieties the highest yield, 48.64 tons per acre, was obtained from a cross of Ailsa Craig and Manx Marvel. The generally better performance of Ailsa Craig types is believed to indicate that the station soil favors this group. The first season's yields are recorded for glasshouses which are to be devoted to investigations concerned with the reduction in yield of the tomato crop which takes place after the first two years.

Studies conducted to determine the cause of reduced yields in cucumber houses after the first season showed steaming to have no durable effect beyond the season of application. Covering the subsoil with a layer of concrete had no beneficial effect, and formaldehyde treatment exerted an apparently deleterious influence. No significant differences were noted whether cucumbers were top-dressed with manure alone, or with manure mixed with loam.

A five-year summation of soil sterilization tests, in which steam, hot water, and carbolic acid were used as media, showed consistent benefit in a house where control yields were low and no benefit in a house where ordinary yields were high. The first year of supplementary tests with carbolic acid, chlorodinitrobenzene, dichlorocresol, emulsified heavy oil, and formaldehyde showed marked benefit in increased yields. Applications of flowers of sulfur resulted in reduced yields.

Carbon dioxide investigations [at Cheshunt, England] (*Expt. and Research Sta., Cheshunt, Herts, Ann Rpt., 9 (1923), pp. 82-94, figs. 6*).—A brief report prepared in two parts, the first of which, by O. Owen, deals with the distribution of CO_2 in glasshouses and leads to two conclusions, namely, (1) CO_2 is not stratified in glasshouses under ordinary commercial conditions and (2) the average concentration varies during 24 hours, ranging from a minimum in the early afternoon to a maximum in the early morning.

Part 2, by O. Owen and P. H. Williams, discusses methods of introducing CO_2 into glasshouses and the effects of several concentrations on tomato production. The generation of CO_2 by treating sodium bicarbonate with sulphuric acid was found much more satisfactory than introducing gas from cylinders. Determinations showed the rate of loss of CO_2 to be constant at any given concentration and to be unaffected by stopping the fan as soon as the bicarbonate was decomposed. The rate of loss of CO_2 was not affected by the introduction of soil into the concrete bottom beds. The gas was found to be uniformly distributed throughout the chambers.

The effect of CO_2 on tomatoes was shown in yields of 45.14, 41.19, 37.40, 38.23, and 36.20 tons per acre, respectively, for the following treatments: (1) Continuous evolution of gas from the soil surface, (2) 10 times the normal CO_2 content, (3) 20 times the normal, (4) 30 times the normal, and (5) the control.

Some relations of hardening to transplanting, W. E. LOOMIS (*Amer. Soc. Hort. Sci. Proc., 20 (1923), pp. 206-215*).—Studies at Cornell University showed that hardening of tomato, cabbage, and cucumber plants by the withholding of water results in diminished transpiration, even though the plants are subsequently supplied with ample water. However, when plants were transplanted following the hardening process, the hard transplanted plants in every instance transpired more per gram of green weight than did tender plants, this difference becoming more marked after the first three or four days. Computations of the transpiration per gram for tops and for roots in transplanted plants indicated a closer relation between total root growth and transpiration than between top and transpiration. Observations on root replacement following transplanting showed hardened plants to become reestablished much more rapidly than tender plants. Chemical determinations showed a

sharp increase in total carbohydrates (sugars and starch) as a result of hardening, especially in the case of cabbage, a plant which transplants easily, thus indicating a correlation between carbohydrate reserve and new root development.

Influence of the time of maturity of onions upon the rest period, dormancy, and responses to various stimuli designed to break the rest period, V. R. BOSWELL (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 225-233) — In continuing investigations (*E. S. R.*, 49, p. 137) conducted at the University of Maryland with a view to determining the factors affecting the length of the rest period of the onion, the author studied growth renewal in early and late maturing Yellow Globe Danvers onions harvested at different times from the same plat and treated in various ways with a view to hastening the resumption of growth.

It was found that the length of the rest period did not vary greatly between the early and late harvested bulbs, except that the former were a little slower in resuming growth. A chemical study showed a slightly higher content of total sugars in the early maturing bulbs. In desiccation studies, the late bulbs lost 44 per cent more water in 29 days than did the early bulbs, suggesting a difference in permeability. The suspicion that the stimulation of growth renewal in onion bulbs following cutting in various ways, especially transversely, was due to an increased supply of oxygen was confirmed by the failure of paraffined cut surfaces to impart any stimulus and by the very slow development of cut bulbs when placed in an oxygen-free chamber. Etherization or freezing failed to affect the duration of the rest period. Shallow planting, with consequent increased sun exposure, apparently slightly retarded growth initiation. In conclusion, it is suggested that differences in the behavior of early and late maturing onions are likely due to inherent variations rather than to any change in the nutritional balance.

Influence of the time of maturity of onions on the behavior during storage, and the effect of storage temperature on subsequent vegetative and reproductive development, V. R. BOSWELL (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 234-239) — This, a companion paper to the above, deals with the behavior during and subsequent to storage at 32, 40, and 50° F. of early and late maturing onion bulbs gathered from the same original planting.

At identical temperatures early maturing bulbs started growth less readily and suffered less loss from decay than did late maturing bulbs. Of the three storage temperatures used, 32° was found the most satisfactory. Flower primordia differentiation was materially inhibited by low temperatures, the lower the storage temperature within the margin of safety the greater being the inhibitory effect.

Onion plants developing from bulbs stored for eight months at 32° were characterized by an exceptionally vigorous leaf growth and a scarcity of flower stalks. Except in the earlier renewal of growth on the part of late maturing bulbs, no consistent difference was noted between the plants developing from the early and the late ripening bulbs. Storage for six months at 32° followed by six weeks at 50° resulted in a much more rapid growth at the latter temperature than for bulbs which had been stored at 50° for the entire period.

The use of statistical data in tomato breeding, H. D. BROWN and I. C. HOFFMAN (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 215-219).—Biometrical studies of the fruits were found useful in tomato investigations conducted by Purdue University in establishing standards for varieties and selected strains. A useful factor for fruit shape was obtained by dividing the mean for the equatorial diameter by the mean for the polar diameter. Records taken dur-

ing a severe outbreak of blossom-end rot following a drought in 1919 showed a positive correlation ($r=0.539\pm0.049$) between the percentage of and the average size of rotted fruits, indicating that large fruits are more susceptible than small fruits. Selected strains of the Red Head and Baltimore varieties averaged 5.5 and 11.7 per cent infection, respectively, as compared with 1.6 for the Globe. It is believed that the differences in amount of infection are due to relative maturity during the critical period of growth rather than to differences in the shape of fruit. R. Magruder failed in the greenhouse to induce blossom-end rot on Baltimore or on Cherry×Baltimore plants by withholding water to such a degree as to cause severe wilting.

The function of nitrogen in the nutrition of the tree, V. R. GARDNER (*Fruit Growers' Assoc. Ontario Ann. Rpt.*, 55 (1923), pp. 63-68).—A discussion of the present status of knowledge.

Spraying Missouri fruits, T. J. TALBERT (*Missouri Sta. Bul.* 216 (1924), pp. 32, figs. 14).—In addition to presenting complete spray schedules for all fruits commonly grown in the State, the author discusses spray materials and their preparation, the relative merits of spray and dust, spraying equipment, and the necessity of thorough timely applications for combating various insect and fungus pests.

Bud and root selection in the propagation of the apple, K. SAX (*Amer. Soc. Hort. Sci. Proc.*, 20 (1923), pp. 244-250).—Measurements of nursery Ben Davis apple trees developed from the union of piece roots and scions, both from parent trees of known productivity, showed in general that roots from productive trees give rise to larger trees than do roots from unproductive parents. The author deems it significant that where there was the greatest divergence in parental performance the selected roots also differed consistently in the same direction. Slight indication was obtained that scion selection may have some effect on the growth of the progeny.

Data taken on young trees grown from buds of productive and unproductive parents worked on uniformly graded American-grown French crab stocks showed in only two instances significant though slight differences in favor of the productive parents. A study of the behavior of the progeny of two pairs of Ben Davis trees, in which was found a difference of nearly four times the probable error between the size of the progeny from the unproductive trees and three times the probable error between the size of the progeny of the two productive parents, is believed to indicate that all differences may be due to environmental factors rather than to inherent characters.

A biometrical study of measurements of the growth of French crab stocks and that of buds of the Ben Davis, McIntosh, Delicious, and Northern Spy varieties grafted thereon showed considerable correlation between seedling caliper in 1922, the year of transplanting, and whip caliper in 1923, the first season after budding. The correlation between caliper of seedlings in 1921 and whip growth in 1923 was, however, only slight, indicating that differences in seedling size at the time of setting had little effect on the size of the whips in 1923. That the position of the bud on the bud stick may have some effect was indicated in the Delicious variety, where a tendency was found for the basal buds to give slightly greater whip growth. Such factors as compatibility between the seedling and the bud, technique of budding, and differences in reserve food supply in the bud are believed to affect the rate of development of the bud.

The beauty and use of the vintage pear, H. E. DURHAM (*Jour. Roy. Hort. Soc.*, 49 (1924), No. 2, pp. 157-166).—In connection with popular comments there is presented a list of varieties, supplemented with brief notes on origin, etc.

Plum and prune growing in the Pacific States, C. F. KINMAN (*U. S. Dept. Agr., Farmers' Bul. 1372 (1924), pp. II+60, figs. 34*).—This is a comprehensive discussion, presenting in detail information concerning favorable growing regions, selection of sites for orchards, varieties, pollination requirements, propagation, general cultural needs, irrigation, fertilization, harvesting, combating of pests, etc.

Blueberry culture, C. W. BECKWITH (*New Jersey Stat. Circ. 170 (1924), pp. 8 figs. 6*).—In briefly discussing improved practices of blueberry growing in operation in southern New Jersey, the author takes into consideration such points as varieties, the selection and preparation of the soil, methods of planting, fertilizers, harvesting practices, and probable yields.

Dewberry growing, G. M. DARROW (*U. S. Dept. Agr., Farmers' Bul. 1403 (1924), pp. II+18, figs. 17*).—In this revision of Farmers' Bulletin 728 (E. S. R., 35, p. 448), information of a general nature is offered concerning the history of the dewberry, location of a plantation, cultural considerations, cover crops, fertilizers, systems of training and pruning, methods of harvesting, diseases and insect pests, pollination requirements, varieties, etc.

An experiment with gooseberry varieties, 1910-1920, [trans. title], N. ESBJERG (*Tidsskr. Planteavl, 28 (1922), No. 4, pp. 596-614*).—Based upon the average of yields during the period 1911-1920, Achilles was the most prolific among eight red-fruited and Whitesmith among seven green-fruited gooseberries. The removal during the winter of approximately 25 per cent of the older branches of gooseberry bushes resulted in decreased yields, amounting to 33 per cent in 1918 and 10 per cent in 1920, the third season after pruning.

The Van Fleet raspberry, a new hybrid variety, G. M. DARROW (*U. S. Dept. Agr., Dept. Circ. 320 (1924), pp. 15, figs. 10*).—A brief discussion concerning a new hybrid raspberry, *Rubus innominatus* × Cuthbert, which, because of its late ripening season continuing that of the standard raspberries for several weeks and high productivity, is considered highly desirable, particularly for home use. Information is offered concerning the growing habit of the plant, methods of propagation and training, and the character of the fruits.

Strawberry culture in Missouri, T. J. TALBERT (*Missouri Sta. Circ. 123 (1924), pp. 12, figs. 6*).—General information is presented upon the culture of standard and everbearing strawberries, taking into consideration soils, sites, varieties, fertilizers, planting, harvesting, combating insect and fungus pests, etc.

Head, cane, and cordon pruning of vines, F. T. BIOLETTI and H. E. JACOB (*California Sta. Circ. 277 (1924), pp. 32, figs. 23*).—Grouping the various successful methods of pruning vines now in practice in California under three general designations, namely, (1) head, (2) cane, and (3) cordon, the authors discuss the three systems and their modifications, outlining the practices employed in training vines according to each system, and listing varieties in relation to their adaptation to the respective types of training.

Culture of olives used for pickling, W. V. CRUESS (*California Sta. Circ. 278 (1924), pp. 2-13, figs. 8*).—This, the introductory portion of the circular noted on page 207, deals with the production in Spain, France, and Italy of olives used for pickling, discussing such points as methods of propagation, varieties, cultivation, pruning, fertilization, and the combating of insect and fungus pests.

The habit of budded cacao, S. C. HARLAND and R. G. PARGA (*Trop. Agr. [Trinidad], 1 (1924), No. 9, pp. 132, 133*).—Observations on cacao trees at the River Estate, Trinidad, indicated that the cacao has two distinct habits of branching, (1) the fan, in which the branches have no definite termination, and (2) the chupon, in which the branches invariably terminate in the usual

five parts, all of which behave like fans. Noting that budded cacao was almost invariably fan form, the authors conducted pruning investigations with both fan and chupon branched trees to determine the constancy of the two habits of growth. It was found that when pruned back 57 out of 59 fans produced fans, and of 40 chupons 24 gave rise to the same type of growth.

Bud selection as related to quality of crop in the Washington Navel orange. A. D. SHAMEL, C. S. POMEROY, and R. E. CARYL (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 521-526, pls. 4).—Further observations (E. S. R., 50, p. 644) upon the character of fruits produced by young orange trees propagated from normal and off-type branches of the Washington Navel orange variety indicated that limb variations may be perpetuated through bud propagation. In the case of propagation from a tree of the Thomson strain, one limb of which bore small sized, early ripening fruits characterized by a pale yellow color and occasionally reddish stripes with sunken brown spots of irregular shape and size, the progeny of a normal limb produced only normal fruits and the progeny of the abnormal limb produced, with one minor exception, only abnormal fruits similar to those of the parent limb. Similar results were obtained in the instances of a limb variation occurring on a tree of the Washington strain except that the fruits of the progeny tree were more variable, including a few normal specimens. Likewise, all four of the progeny trees from abnormal limbs were smaller and of a more compact form than normal trees of their respective strains. In general conclusion, the authors suggest that the tests emphasize the fundamental importance of careful bud selection in citrus propagation.

[A qualitative study of phosphorus fertilizers], R. W. RUPRECHT (*Florida Sta. Rpt.* 1923, pp. 48, 49).—Of five sources of phosphoric acid, namely, (1) acid phosphate, (2) steamed bone, (3) soft phosphate, (4) pebble phosphate, and (5) commercial fertilizer, used in a test of the relative availability, none had marked superiority, as indicated in averages of 5 years' yields of grapefruit trees.

The date-palm in antiquity, P. POPENOE (*Sci. Mo.*, 19 (1924), No. 3, pp. 313-325).—A popular discussion in which attention is directed to references to the date palm in early historic and legendary literature.

Filberts, C. E. SCHUSTER (*Oregon Sta. Bul.* 208 (1924), pp. 3-39, figs. 17).—This paper is presented in two parts, the first of which (pp. 5-24) comprises a general discussion upon filbert production in Oregon, taking into consideration such details as propagation, varieties, culture, pruning, harvesting, etc., and the second part (pp. 25-38) embraces the results of pollination studies, in which it was determined that most of the varieties considered were practically self-sterile, and that all were benefited by interplanting with compatible sorts. The blooming time of the filbert, according to variety and season, was found to extend over a long period, from January 1 to March 31 in western Oregon. Moderate frosts had no deleterious effect on either pollen or pistil, the latter, however, being the less resistant, killing back to the bud scales at temperatures of from 12 to 15° F. Pistils were found to be in a receptive condition over an extended period. The best germination of pollen in artificial media was secured when a sugar solution of from 12 to 15 per cent was utilized.

The results of tests, in which leading commercial filbert varieties were pollinated with various other sorts in an attempt to discover suitable pollinizers, led to the recommendation of White Aveline, Daviana, Du Chilly, and Nottingham as interplants for Barcelona, the leading commercial variety grown in Oregon. For the Du Chilly variety, Daviana, Alpha, Clackamas, and Chaperone proved satisfactory pollinizers. Attempts to cross commercial

varieties (*Corylus avellana*) with pollen of *C. colurna* and *C. californica* gave entirely negative results, as did the reciprocal cross, *C. colurna* × *C. avellana*. Insignificant differences were obtained when the Barcelona variety was pollinated with pollen of the Du Chilly, Daviana, and Merveille de Bolwyller obtained from different localities. As a practical suggestion, it is recommended that in planting filbert orchards at least one tree in every nine be a suitable pollinizer.

Stimulation of cuttings [trans. title], HERELE (*Gartenwelt*, 28 (1924), No. 35, pp. 401, 402, fig. 1).—The immersion for two hours of dahlia and ageratum cuttings in various strength solutions of magnesium chloride showed that this chemical at certain concentrations, namely, $N/3$ for one hour for the dahlia and $N/2$ for one hour for the ageratum, has a distinctly beneficial effect in stimulating root and top growth of cuttings. Strangely enough, the immersion of dahlia cuttings in distilled water for two hours gave deleterious results, believed to be due either to the rupturing of cells in the callus tissue or to the loss of protective substances. The ageratum was found more resistant than the dahlia to strong solutions of the chemical.

The production of Narcissus bulbs, D. GRIFFITHS (*U. S. Dept. Agr. Bul. 1270* (1924), pp. 32, pls. 9, figs. 3).—Based on investigations conducted in the region of Puget Sound, Washington, and in other parts of the country, the various factors concerned in the production of Narcissus bulbs in the United States are comprehensively discussed, taking into consideration such points as planting, culture, harvesting, curing, storage, preparation for market, fertilizers, insect and fungus pests, taxonomy, varieties, and varietal peculiarities.

Rhododendrons, their names and addresses, E. H. WILDING (*London: Sifton Praed & Co., Ltd.*, 1923, pp. 105).—Alphabetically arranged according to species, this small handbook is designed to serve as a ready reference to the *Rhododendron* genus.

Planting home grounds, A. MACDONALD (*Wichita, Kans.: Bd. Park Commrs.*, 1924, pp. XI+93, figs. 56).—This popular discussion of the improvement of home grounds is devoted for the greater part to trees, shrubs, and plants found suitable in the somewhat adverse climate of southern and central Kansas.

FORESTRY

Forest types in the central Rocky Mountains as affected by climate and soil, C. G. BATES (*U. S. Dept. Agr. Bul. 1233* (1924), pp. 152, pls. 11, figs. 10).—Following an earlier report (*E. S. R.*, 49, p. 535), in which it was shown that under controlled laboratory conditions forest trees exhibit a distinct species response to environmental conditions, such as moisture, heat, and light, the author, in this paper, discusses data obtained at a large number of field stations located on representative sites throughout the central Rocky Mountain region. In general, the field data accorded with the laboratory results.

Evidence was obtained that the distribution of trees in the central Rocky Mountain region is controlled almost entirely by the degree of insolation of the site. Any variation between two sites in respect to wind, humidity, temperature, or soil moisture had an apparent effect on the vegetation. A closer correlation was noted between soil temperature at a depth of 1 ft. and reproduction of a given species than between the surface temperature and reproduction. Direct insolation in winter, by preventing deep freezing of the soil, is considered an important factor in keeping moisture available for both young and old trees, and, since moisture supply was not a critical factor on any of the sites

considered in the study, the drying effect of direct sunlight in the growing season was not found a vital problem.

Western yellow pine is described as a liberal user of water and relatively inefficient in photosynthesis, hence well adapted to full sunlight and warm atmospheres. Warmth of the soil in winter and an available supply of water are deemed vital necessities for this species. Douglas fir, occurring as a close competitor of yellow pine, was apparently less able in the seedling stage to resist high temperatures of direct sunlight. Douglas fir, however, used less water and was more tolerant of shade and more effective in photosynthesis than the pine. Engelmann spruce was found even more effective in photosynthesis and a more economical user of water than Douglas fir, and its seedlings, in spite of slow root penetration, were less easily injured by high temperatures, except in the presence of drought. It is believed that Engelmann spruce occupies cold sites and high elevations because of its ability to grow with less direct light and lower temperatures than those required by the other species. Lodgepole pine, apparently a more effective user of light than yellow pine and more conservative of water, was better able to resist the heating effect of direct sunlight and hence able to establish itself in completely denuded soils. Its seeds, apparently requiring the stimulation of frequent and wide ranges of temperature, were also well adapted to exposed sites. The temperature and moisture conditions peculiar to the different slopes and elevations considered in the study are discussed in relation to their effect on tree growth and adaptation for the several species.

As a practical application of the results of the study, the author suggests the possibility of obtaining stands of Douglas fir on open sites by the use of older planting stock, thus avoiding the necessity of going through the yellow pine stage incident to a natural succession. It is suggested that cutting operations be planned with a view to encouraging desirable species, even if not in the natural order of succession, and the manner of brush disposal is also considered as a valuable means of encouraging or discouraging any given species.

The trees and shrubs of Yellowstone National Park, P. H. HAWKINS (*Madison, Wis.: Author, 1924, pp. [3]+125, figs. 25*).—General information is presented upon all the trees and shrubs of the Yellowstone National Park, with special reference to their economic uses and their relations to wild life.

Small rodents and northeastern conifers, A. V. S. PULLING (*Jour. Forestry, 22 (1924), No. 7, pp. 813, 814*).—Casual observations in different sections of northeastern America over a period of years have indicated to the author that squirrels, in particular, destroy an enormous quantity of coniferous seeds, and that except in years of abundant seed crops they are a potent factor in reducing reproduction, especially in white pine.

[Forestry investigations at the Pennsylvania Station], J. A. FERGUSON (*Pennsylvania Sta. Bul. 188 (1924), p. 21*).—Records taken in 1923 upon cuttings taken from six Carolina poplar stumps, which from the date of planting, 1911, had been annually utilized as a source of cutting material, showed an average of 17 sprouts per stump. The sprouts averaged 3.6 ft. in length, and the total length of all the sprouts from the six stumps was 342.2 ft. No diminution of yield has been noted as a result of the annual cutting.

Black walnut for timber and nuts, W. R. MATTOON and C. A. REED (*U. S. Dept. Agr., Farmers' Bul. 1392 (1924), pp. [2]+30, figs. 17*).—The authors discuss, among other considerations, the present range of the tree, soil preferences, growth rates, the value of the wood and of the nuts, methods of propagation, practices of growing for timber and for nut production, the handling of the nuts, and the estimated returns from the sale of wood and nuts.

Identification of Philippine woods by anatomical characters, R. KANEHIRA (*Taihoku, Taiwan: Govt. Research Inst., 1924, pp. [2]+75, pls. 2*).—Herein are reported the results of a microscopic study of the wood of 155 Philippine species, representing 108 genera and 41 families of dicotyledons and 5 species and 4 genera of gymnosperms. An anatomical key is included. This is a supplement to the publication on Formosan woods (E. S. R., 46, p. 143).

Anatomical notes on Indian woods, R. KANEHIRA (*Formosa [Taiwan] Govt. Research Inst., Dept. Forestry Bul. 4 (1924), pp. [3]+40 pl. 1*).—Similar to the above, there are presented the results of a study of woods obtained from the Forest Research Institute at Dehra Dun, India.

The work of a forest protective association, A. F. HAWES (*Hartford: [Author], 1924, pp. 31, figs. 8*).—After briefly discussing the extent of forest fires in Connecticut in 1923, the author considers the development of forest protective associations, and suggests equipment and practices of value for combating not only fires but also insects and diseases, and for protection against theft.

Forestry almanac (*Washington: Amer. Tree Assoc., 1924, pp. VIII+225, figs. 12*).—A compilation of general information on the forestry situation in the United States, outlining the activities of various organizations, public and private, concerned in the advancement of forestry and presenting statistical data concerning forest depletion, national forests, planting activities, etc. The situation in various foreign countries is also briefly considered.

Thirteenth annual report of the State forester to the governor for the year ending December 31, 1923, F. A. ELLIOTT (*Oreg. State Forester Ann. Rpt., 13 (1923), pp. 47*).—This, the usual annual report (E. S. R., 50, p. 647) includes in addition to general data the text of a forest policy for Oregon adopted by the Oregon State Board of Forestry on December 4, 1920.

Report of the forest branch of the Department of Lands, [British Columbia], for the year ending December 31st, 1923, P. Z. CAVERHILL ET AL. (*Brit. Columbia Dept. Lands, Forest Branch Rpt. 1923, pp. E63, pls. 4, figs. 10*).—This is the usual annual report (E. S. R., 49, p. 838), taking into consideration the amount and kinds of timber cut during the year, the work in the control of insects and fungus diseases, fire protection, grazing activities, etc. Appended are the reports of the committees on forest fire protection and silviculture in Canada, delivered before the British Empire Forestry Conference, held in Ottawa in 1923.

Report on forest administration for the year 1923, G. E. S. CUBITT (*Fed. Malay States Forest Admin. Rpt. 1923, pp. 46*)—This is the usual administrative report (E. S. R., 50, p. 40) concerning the constitution of the forests, silvicultural activities, forest produce, etc.

Annual report on the forestry department for the year ended 31st December, 1922, R. FYFFE (*Uganda Forestry Dept. Ann. Rpt. 1922, pp. 14*).—This is the usual annual report (E. S. R., 48, p. 740), devoted for the most part to the lumber output, alterations in area, changes in personnel, etc.

DISEASES OF PLANTS

Report of plant pathologist, O. F. BURGER (*Florida Sta. Rpt. 1923, pp. 52-61, 63-102*).—Spraying experiments are reported, in which Bordeaux mixture plus 1 per cent oil emulsion was used for the control of melanose of oranges and grapefruit. The sprayed trees yielded nearly three times as many first-class quality fruits as the unsprayed, with a corresponding reduction in the percentages of the lower grades.

Studies of the life history of the citrus canker organism are reported to show that it grows readily on potato agar without losing its virility. It was also able to live on sterilized wet pine shavings, filter paper, etc., for several months. Unsterilized muck soil was unfavorable to the growth of the organism, and grapefruit seedlings planted in soil inoculated with cultures of the organism were free from the disease. Leaf inoculations made in the fall and winter with suspensions of the organism did not show infections for 30 days where the leaves were not wounded, but when the leaves were wounded infection was evident in from 7 to 10 days. Inoculations made during the summer produced infections much sooner.

Black rot of oranges due to *Alternaria citri* is reported on a number of varieties of oranges in addition to navel oranges, losses as high as 25 per cent being attributed to this cause.

A green spotting of oranges was found to be due to oil liberated from the oil sacs through injury to the skin of the fruit.

Experiments to determine whether the organism causing citrus scab could be carried by seed gave negative results with sour oranges.

The assistant plant pathologist, G. F. Weber, conducted experiments to determine the effect on germination of presoaking seed before treating them with corrosive sublimate solution 1 : 1,000. Seed of beet, cabbage, cucumber, eggplant, okra, watermelon, squash, beans, and cantaloupe were treated, and all except the eggplant showed a higher germination after soaking from 1 to 3 hours before disinfection. After soaking for 3 hours germination was diminished, and seed soaked for 8 hours showed from 20 to 25 per cent decrease in germination. Considering the time and labor required for the presoaking, the author does not consider such a practice profitable.

A mosaic disease of sweet potatoes is reported in which no mottling was observed on the plants, but the growth was stunted. The leaf tissue between the veins was raised into pouchlike areas. Inoculation experiments in attempting to reproduce mosaic gave negative results.

A study was made of seed potatoes received from without the State. Many lots were found to be badly damaged by bruising, and others were infected by species of *Fusarium*. Certified seed were less affected than common stock.

A report is given of experiments on the control of late blight of potatoes, in which spraying with Bordeaux mixture was compared with dusting with copper lime dust. Gains of about 20 per cent are reported for both treatments, but dusting cost \$3.10 per acre more than spraying. Bodo paste was found no more effective than copper-lime dust, and the cost of the commercial mixture was much greater.

A list is given of the diseases of plants reported by members of the station staff as observed in Florida during the year.

[Plant disease investigations of the Mississippi Station], D. C. NEAL (*Mississippi Sta. Rpt. 1923, pp. 30-35*).—An account is given of testing varieties of tomatoes for wilt resistance, in which several selections have proved superior to plants of varieties grown from commercial seed. The author calls attention to the fact that continued selection of resistant strains did not appear to increase the resistance of a variety of tomatoes to the wilt disease.

A brief note is given of spraying experiments for the control of pecan scab, a more extended account of which has been noted (*E. S. R.*, 52, p. 152).

Experiments with inoculated sulfur for the control of root knot of peach trees are noted, as well as cabbage yellows and stem rot of sweet potatoes.

A pathological study has been made of the anthracnose fungus, *Colletotrichum trifolii*, of alfalfa, which is said to cause serious trouble in parts of the State. Twenty-four strains and varieties of alfalfa were tested for resistance to this disease, with negative results.

A list is given of a number of plant diseases observed in the State during the year.

Botany and plant pathology (*Pennsylvania Sta. Bul.* 188 (1924), pp. 13, 14, 14-16).—Investigations by C. R. Orton and J. P. Kelly have indicated that inheritance of immunity to potato wart may be derived through crosses and self-pollinations, and owing to the heterozygous constitution of potato varieties, segregation is obtained in the F_1 generation. The behavior of immunes on inbreeding indicated that immunity is a dominant characteristic and susceptibility a recessive. In connection with their studies some data were obtained on the transmission of tuber coloration in the variety Red McCormick.

Experiments by C. R. Orton indicate that mulching with wheat straw reduced wilt infection of potatoes due to *Fusarium oxysporum* and nearly doubled the yield.

As a result of experiments by C. R. Orton and E. G. Rex, it is believed that the organism causing blackleg of cabbage exists in the soil as well as in infected seed. The organic mercury compounds used as seed disinfectants have given some indications of affording relief. Field experiments are said to indicate that those seedlings transplanted to moist soil are more free from the disease than those transplanted to a relatively dry soil. The histological studies of infected seed have shown that the mycelium is not confined to any particular part of the seed.

Six years' experiments on the control of apple blotch, reported by R. C. Walton, indicate that the time of infection is variable, and that the results for one year can not be taken as indicative of what may happen another year. In 1922 infection started very early, but the following year it was late in appearing. The limiting factor is considered probably to be the amount of precipitation.

For the control of black rot of apple, R. C. Walton has tested a number of different materials, spraying being carried on in seven orchards, but in 1923 there was so little frog-eye present that data are not considered at all conclusive. All efforts to determine the cause of frog-eye have resulted in failures.

W. S. Beach, reporting on diseases of truck crops caused by *Sclerotinia* and *Botrytis*, has found that spraying formaldehyde on soil in a strong solution and afterwards diluting it with sufficient water to carry the disinfectant to proper depths into the soil has given excellent results for the control of *Botrytis* and *S. libertiana* on lettuce. In connection with this investigation a state of compactness and dampness of the soil, with its resultant effect on the rate of water penetration, was found to be an important factor.

The same investigator has given a brief account of downy mildew of Lima beans due to *Phytophthora phaseoli*, pod blight (*Diaphorthe phaseolorum*), and leaf spotting by *Phylllosticta phaseolina*. Dusting Lima beans with copper lime dust containing 14.5 per cent monohydrated copper sulfate gave efficient control of downy mildew in 1923.

Notes are given on a rhubarb disease, further experiments indicating that *Phytophthora cactorum*, *P. parasitica*, and the species isolated from Illinois rhubarb are probably the only species truly parasitic on rhubarb.

For the control of apple scab, H. W. Thurston reports lime-sulfur spray somewhat more effective than the dust.

Puccinia graminis poae Erikss. and Henn. in the United States, E. C. STAKMAN and M. N. LEVINE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 541-548, pl. 1, figs. 2).—The presence of heavily infected specimens of *Poa compressa* was reported in the vicinity of Pontiac, Mich., in 1922. The material was sent to the authors for identification, and as the result of inoculation experiments the rust was determined as *Puccinia graminis poae*. So far it has

been found abundant only near barberry bushes. Epidemics in 1922 and 1923 near Pontiac, Mich., and in the vicinity of North Vernon, Ind., in 1923 are said to have been associated with rusted barberry bushes.

Reaction of barley varieties to *Helminthosporium sativum*, H. K. HAYES, E. C. STAKMAN, F. GRIFFEE, and J. J. CHRISTENSEN (Minnesota Sta. Tech. Bul. 21 (1923), pp. 3-47, figs. 10).—The results are given of studies of varietal resistance to *H. sativum* and inheritance studies of a cross between the barley varieties Lion and Manchuria. A study of varietal resistance made by sowing each variety in a 5-ft. row and spraying the plants at heading time with spore suspensions of *H. sativum* gave some very promising results.

In general, varieties which proved resistant one year tended to be resistant the following year. The barleys of the Manchuria type were rather resistant, while other varieties were extremely susceptible or rather susceptible. Correlation coefficients of susceptibility were calculated for 49 varieties or strains grown in 1920 and 1921, and notes were taken on the degree of infection of foliage, roots, and spikes. Seedlings of 98 barley varieties were grown in the greenhouse in soil inoculated with cultures of *H. sativum*, and notes were taken on root infection. Thirty-nine smooth-awned hybrids which appeared homozygous were obtained for the most part from crosses between a smooth-awned susceptible variety and a rough-awned resistant one.

In the second part of this contribution the results are given of studies on the inheritance of awn habit and black and white color, inheritance of reaction to *H. sativum*, and correlation between reaction to *H. sativum* and botanical characters. The crosses studied were made between Lion, a six-rowed, black, smooth-awned variety, which is susceptible to attacks of *H. sativum*; and Manchuria, a six-rowed, white, rough-awned, resistant variety. The rough-awned character proved dominant to smooth awns, and in F_2 the ratio of rough to smooth-awned plants was approximately 3:1. Different degrees of smoothness of awn were observed in some plants, and while in the crosses the rough v. smooth-awned character appeared to be dependent on a single factor difference, the degree of smoothness of the awn appeared to be dependent upon modifying the factors. Some lines bred true in F_3 and in later generations for various degrees of smoothness. Black v. white color is believed to be apparently dependent upon a single genetic factor which was inherited from the main factor difference for rough v. smooth awn.

When 124 F_2 lines of the Manchuria-Lion cross were tested for susceptibility to *H. sativum*, 8 lines were obtained which were as susceptible in both the F_2 and F_3 generations as the variety Lion, and 6 lines which were approximately as resistant as Manchuria. Resistance and susceptibility to *H. sativum* are considered inherited characters, although apparently dependent on more than a single genetic factor. A greater proportion of the resistant strains was of white color and rough awn barleys than of the susceptible families. However, within the 124 F_2 lines grown, all combinations of resistance and susceptibility, smooth and rough awn, and black and white color were obtained.

Relation of soil temperature and soil moisture to infection by *Plasmodiophora brassicae*, J. MONTEITH, JR., (Jour. Agr. Research [U. S.], 28 (1924), No. 6, pp. 549-562, pls. 5).—The results are given of a study of soil temperature and soil moisture as affecting the severity of clubroot of cabbage.

Using the Wisconsin tank method of control, clubroot was found to develop through a range of temperature from 9 to 30° C., and within this range the disease seemed directly correlated with the effect of temperature upon the growth of the plants. The author believes that the influence of temperature is only secondary, and that in the field it is not a limiting factor. On the other hand, soil moisture was found to be an important factor, the disease develop-

ing on plants grown in soil maintained at 60 per cent of the water-holding capacity and at all higher moistures, but not in soil kept at 45 per cent or less. The injury to the plants increased with an increase of moisture above 60 per cent. It is thought that the failure of the disease to develop on plants grown in infested soil with a low moisture content is due to insufficient moisture for spore germination.

Under natural field conditions it is believed that a long period during which the soil is so dry that no clubbing would develop may give the plants an opportunity to produce a good crop regardless of short wet periods.

Comparing previous reports on clubroot, the author believes that soil temperature and moisture, especially the latter, may help to explain the conflicting results secured concerning the use of lime and the relation of soil acidity to the clubroot disease.

The control of bacterial blight of celery by spraying and dusting, H. W. DYE and A. G. NEWHALL (*New York Cornell Sta. Bul.* 429 (1924), pp. 3-30, figs. 10).—After giving a description of the bacterial blight of celery caused by *Pseudomonas apii*, the authors describe experiments for the control of the disease by spraying and dusting.

It was found that the bacterial blight of celery could not be controlled by sulfur fungicides, while copper fungicides were very effective in the control of this disease whether applied in the form of sprays or dusts. Bordeaux mixture 5-5-50 and copper-lime dust 15-85 proved the most efficient of several substances tried over a period of five years. Proprietary compounds were not so effective in controlling the disease, except at strengths which were much more expensive than Bordeaux mixture. The addition of resin-fish-oil sticker to homemade Bordeaux mixture did not give any better blight control. Copper-lime dust cost nearly twice as much as did homemade Bordeaux mixture, but the initial cost of materials was somewhat decreased by the reduced amount of time required to cover a given acreage and by the elimination of considerable labor. Under some circumstances it was found advantageous to make three applications of 20-80 copper-lime dust to plants in the seed bed, particularly when late blight was present.

Corn root, stalk, and ear rot diseases, and their control through seed selection and breeding, J. R. HOLBERT, W. L. BURLISON, B. KOEHLER, C. M. WOODWORTH, and G. H. DUNGAN (*Illinois Sta. Bul.* 255 (1924), pp. 239-478, pls. 6, figs. 121).—In this study, made in cooperation with the Bureau of Plant Industry, U. S. D. A., the causes and symptoms of a number of corn rots are described, and notes are given of some other corn diseases that are of economic importance. Among the diseases described are scutellum rot, mostly due to *Rhizopus* sp.; Diplodia rots and seedling blight, *D. zeae*; Fusarium root and ear rot, *F. moniliforme*; black bundle disease, *Cephalosporium acremonium*; Gibberella root and ear rot and seedling blight, *G. saubinetii*, etc. The influence of environmental factors on the development of the diseases and the economic importance of corn diseases are discussed at some length.

Considerable attention is given to the physical characteristics of seed ears as associated with seed infection, and to resistance and susceptibility to root, stalk, and ear rot diseases. A program for corn improvement is also presented, as well as a list of 116 references.

A study of wilt resistance in flax, H. D. BARKER (*Minnesota Sta. Tech. Bul.* 20 (1923), pp. 3-42, pls. 14).—A description is given of flax wilt due to *Fusarium lini*, together with an account of experiments for the development of resistant strains of flax.

Individual plant selections were made from several varieties grown on sick soil, and seed was saved from the most resistant plants, as well as from the partially wilted ones. The progeny of these plants were selfed for two years, and the degree of resistance was practically the same in all. There are apparently different degrees of resistance, and it is claimed that highly resistant plants can be obtained immediately by selection in the field. Such plants are said to breed true for resistance. There was no indication found that resistance is developed as a result of constant association with the fungus, and reselection or constant association with the disease did not change the degree of resistance of selected genotypes. Not all varieties of flax tested were found to contain resistant types.

The effect of growing flax plants on sick soil is said merely to eliminate the susceptible strains and to permit the survival of resistant ones. Wilt-resistant strains do not lose their resistance when grown on clean soil. The optimum temperature for the growth of the flax plant is said to be fairly low, while that of the organism causing wilt is fairly high. Consequently more wilt is to be expected when flax is grown at high soil temperatures than when it is grown at lower temperatures. This is associated with time of sowing. Two wilt-resistant varieties have been developed in connection with these investigations, and extensive field trials have been made of them to prove their value. One variety was found to be not only resistant to wilt but also partially resistant to flax rust caused by *Melampsora lini*.

There is said to be some evidence of the occurrence of several physiological races of *F. lini*.

The importance and natural spread of potato degeneration diseases, D. FOLSOM and E. S. SCHULTZ (*Maine Sta. Bul. 316 (1924), pp. 28, pls. 4*).—The authors claim that Maine conditions are relatively unfavorable for the development and spread of degeneration diseases or for a great reduction of yield rate by them. Such diseases, however, are said to cause more degeneration or running-out of potatoes in Maine than is necessary or desirable.

The types of diseases reported upon are mosaic, leaf roll, and spindle tuber. In 1923 tests were made of the effects of spindle tuber upon Green Mountain and Irish Cobbler potatoes and of mild mosaic upon Green Mountain, in which the yield rate was reduced to the extent of from 20 to 40 per cent. Differences due to disease are said to have been much more significant than differences due to strain or origin. Attention is called to the fact that aphids can transmit diseases, and evidence is presented to show that they may spread so as to infect half the plants in the first five healthy rows next to the diseased ones. In other places the diseases spread across the healthy field as far as the fortieth or fiftieth row. Hill-to-hill spread was found to be quite common. Data are presented regarding the spread of mosaic compared with the spread of spindle tuber, the direction of spread, the results of growing parts of the same strain in different places, the harboring of mosaic by Irish Cobblers, partial infection of tubers, and the abundance of aphids.

It is claimed that in many apparently good fields at least 10 per cent of the possible gross yield is lost through degeneration diseases, and that these losses can be avoided by giving due consideration, when selecting seed, to the presence of degeneration diseases in the field and to the probability of their spread and increase.

Tobacco disease investigations, W. B. TISDALE (*Florida Sta. Rpt. 1923, pp. 128-139, figs. 5*).—Descriptions are given of black shank, root rot, Phyllosticta leaf spot, wildfire, Granville wilt, angular leaf spot, root knot, and mosaic as affecting tobacco plants.

The black shank, which is due to *Phytophthora nicotianae*, has been investigated at some length, and the cultural relations of the causal organism determined in part. The disease did not develop in healthy young tobacco plants at temperatures from 10 to 14° C. Moisture is said to be necessary to produce infection on leaves, and experiments have shown that *P. nicotianae* did not survive in infected tobacco leaves which had gone through the ordinary sweating and curing processes. The organism is said to persist in the soil for at least five or six years after tobacco culture has been discontinued. Experiments are in progress in the development of strains of tobacco resistant to this fungus, and some promising selections have been secured. An attempt was made to control the fungus by spraying tobacco plants with Bordeaux mixture, different strengths being employed, but there was no indication of any retardation in the development of the disease.

In connection with root rot investigations, some promising strains of resistant tobacco have been secured. In studies of wildfire, practically every infected seed bed investigated was found to have been covered with second-hand Connecticut cloth or planted with Connecticut seed. Observations are said to indicate that the disease is most serious in sun-grown tobacco and more serious under slat shade than under a combination of slat and cloth shade. Spraying with Bordeaux mixture is reported to have proved beneficial in controlling wildfire.

A bacterial leaf spot which differed from wildfire was found. A white organism was isolated and the disease reproduced in healthy plants by spraying water suspensions of the organism on uninjured leaves. Cultural characters of the organism and symptoms of the disease are said to agree closely with the leaf spot described by Fromme and Murray as due to *Bacterium angulatum* (E. S. R., 40, p. 848).

Tobacco diseases and their control, J. JOHNSON (*U. S. Dept. Agr. Bul. 1256* (1924), pp. 56, pls. 17, figs. 24).—After a general account of the nature of plant diseases as related to the tobacco industry and seed bed management, the author describes a large number of diseases, mentions their causal agencies so far as they are known, and suggests means for their control.

Among the diseases which are considered most important are damping-off or bed rot, sore shin or stem rot, black shank, hollow stalk, Granville wilt, Fusarium wilt, black root rot, brown root rot, root knot, attack of broom rape, wildfire, black fire, Wisconsin leaf spot, frog-eye, and blue mold. Notes are also given on a number of minor leaf diseases due to various causes, as well as on mosaic, frenching, sand-drown, and other malnutrition troubles and injuries due to physical agencies.

A bibliography of 123 titles of articles published in the United States is given.

Tomato wilt and its control in Arkansas, J. A. ELLIOTT (*Arkansas Sta. Bul. 194* (1924), pp. 3-11, pls. 5, fig. 1).—This bulletin, prepared by H. R. Rosen from notes made by Elliott, includes data on experiments conducted by Elliott during the seasons 1918-1922, and experiments by Rosen in 1923.

The symptoms of tomato wilt caused by *Fusarium lycopersici* are described, and the results are given of six years' experiments with wilt-resistant varieties of tomatoes. As a result of these tests it is shown that Delaware Stone Cross (originated by T. F. Manns of the Delaware Station), Delaware Stone, Marvel, and Norton (U. S. Department of Agriculture selections), Edgerton Red Hybrid, and Arkansas Stone selection have all proved resistant to the disease, and these varieties are recommended for planting in Arkansas.

Apple blotch control in Missouri, T. J. TALBERT (*Missouri Sta. Circ. 124* (1924), pp. 8, figs. 2).—Apple blotch, due to *Phyllosticta solitaria*, which is

said to cause serious losses in Missouri, is described, and attention is drawn to the relative susceptibility of a considerable number of varieties to this disease.

Spraying experiments for the control of blotch indicate that Bordeaux mixture has given better control than any other chemical used. A 3-4-50 Bordeaux mixture is recommended for use, the first application to be made within 14 days after the fall of the petals, to be followed by further sprayings at intervals of about 2 weeks. Since the blotch is carried over the winter on twigs, spurs, and branches, the author recommends the cutting out of infected portions of the trees as far as possible.

Botryosphaeria and Physalospora on currant and apple, C. L. SHEAR, N. E. STEVENS, and M. S. WILCOX (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 589-598, pls. 2, figs. 3).—From information obtained by the authors it is considered that the ascogenous stages of these fungi are so similar as to suggest their very close relationship, and that both forms of *B. ribis* occur on apple, on which host at least one form seems to be parasitic and capable of producing a rot under some circumstances. The differences between the two genera, as the names were used, are considered the apparent difference in life histories, the first having a *Dothiorella* as its pycnidial stage and the second *Sphaeropsis* as its pycnidial stage. The ascogenous stages may be distinguished by the size of the ascospore, difference in germination, and by certain cultural characters. The fungus on the apple in Africa described as *B. mali* is considered apparently identical with the variety *B. ribis chromogena*. The fungus found on apple in this country, which has *Dothiorella* as its pycnidial stage and closely resembles that from Africa in its morphology, but is nonchromogenic, is apparently identical with *B. ribis*.

Physalospora malorum on currant, N. E. STEVENS (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 583-588, pls. 2).—In a previous publication (E. S. R., 25, p. 848) the occurrence of a fungus resembling *P. malorum* was reported. The author studying this disease during a period of six years reports having frequently found this *Sphaeropsis* on dead currant canes, often in close association with *Botryosphaeria ribis* or its form, *B. ribis chromogena*. In the summer of 1923 mature perithecia of the fungus were found, and its identity with *P. malorum* was established by morphological and cultural studies.

Two hitherto unreported diseases of stone fruits, C. C. LINDEGREN and D. H. ROSE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 6, pp. 603-605).—The authors report having found, on peaches shipped from California, a rot from which a fungus similar to *Botrytis cinerea* was isolated, and inoculation experiments showed that it was the cause of the disease. Experiments indicated that the fungus was able to penetrate the uninjured skin of the fruit.

They also found on sweet cherries shipped from Michigan a rot from which a species of *Alternaria* was isolated, but no proof was found that the *Alternaria* from sour cherries is identical with that from sweet cherries. Cross-inoculation experiments showed that both strains are pathogenic to both kinds of cherries, and that the fungus is unable to penetrate the uninjured skin of the fruit.

Dieback of citrus, R. W. RUPRECHT (*Florida Sta. Rpt.* 1923, pp. 46-48).—In a study of the relation of fertilizing elements on die-back of citrus the author reports a mild case of the disease which was apparently cured by a reduction in the amount of ammonia applied to trees in the fall. Manure used in connection with applications of commercial fertilizers appears to protect the soluble salts present. Various sources of ammonia were found to increase the leaching of soluble salts, and sulfate of ammonia caused increased losses of calcium and potash. Nitrates tended to increase the loss of sulfates.

On a disease of cocoa and coffee fruits caused by a fungus hitherto undescribed, R. J. TABOR and R. H. BUNTING (*Ann. Bot. [London]*, 37 (1923), No. 145, pp. 153-157, figs. 3).—Liberia coffee cultivated in the Gold Coast Colony is said to be subject to a disease attacking the fruit so prevalently in wet seasons as to endanger the whole crop. The first indication is a dark purplish-brown discoloration of the berry. This later becomes covered with a white or pinkish-brown mealy incrustation formed by the conidia of a fungus always associated with the disease. Fruits of all ages may be attacked, young berries most seriously. The same fungus also causes a disease of cacao fruit, and cross inoculations have been effected, showing characteristic symptoms in each case. In natural infections the symptoms of the disease, known locally as mealy pod, are similar to those caused by *Phytophthora faberi*. Such infection experiments as have been made tend to indicate that it develops much more readily on wounded or dying fruits than on healthy specimens. It has never been found on the vegetative parts of its hosts. The characters of the organism are discussed.

The authors are inclined to place the fungus in a new genus, and it is here described as the new genus and species *Trachysphaera fructigena*. Further investigation of problems connected with the parasitism of the fungus is being carried on in the mycological laboratory, Department of Agriculture, of the Gold Coast Colony at Aburi.

Effect of kiln drying, steaming, and air seasoning on certain fungi in wood, E. E. HUBERT (*U. S. Dept. Agr. Bul.* 1262 (1924), pp. 20, pls. 5, figs. 2).—A report is given of a study of logs of about 20 species of coniferous and hardwood trees from various parts of Wisconsin and Oregon. In these logs about 20 species of fungi were recognized as associated with various types of decay. In addition a number of other rots and stains were observed, the causes of which were not determined.

The effect of various methods of seasoning timber on the fungi was investigated, and it was found that they could be effectively arrested in their development through sterilization by heat. Of the various fungi tested the blue-stain fungi appeared to be the most resistant to heat. No great differences were observed in resistance to heat among the various rot-producing fungi. Commercial kiln conditions and steaming processes coming within the effective limits of temperature and time as determined by the tests were effective in sterilizing infected wood up to and including pieces 4 by 4 in. square. Sterilization was also effected by steam pressure treatments. Methods of piling and storage are considered important factors in protecting wood against deterioration due to fungi. Certain fungi were found to continue to develop in wood as long as favorable conditions were present and to revive and continue their development after long periods of drying.

From the data obtained the author assumes that wood that is properly kiln dried will be sterilized, and that with proper storage it will remain bright and sound.

Root-knot nematode, J. R. WATSON (*Florida Sta. Rpt.* 1923, pp. 108, 109).—Satisfactory results are reported in controlling nematodes in the soil by growing bush velvet beans under constant cultivation. The author recommends that the cultivating be done at least once a week, with one or two careful hoeings and hand weeding to remove all grass and weeds.

Experiments were continued for the destruction of nematodes by chemicals, particularly in seed beds, and treating soil with sodium cyanide and ammonium sulfate gave satisfactory results in reducing the number of nematodes in the soil. Calcium cyanide, which disintegrates more rapidly than sodium cyanide,

is considered promising for the destruction of nematodes in the soil. Experiments with sulfur for the control of nematodes have been begun, and the preliminary work is said to indicate some degree of nematode control.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Damage to range grasses by the Zuni prairie dog, W. P. TAYLOR and J. V. G. LOFTFIELD (*U. S. Dept. Agr. Bul. 1227 (1924), pp. 16, pls. 6, figs. 2*).—This is a report of experiments conducted cooperatively by the Biological Survey, the Carnegie Institution of Washington, the Forest Service, and the Arizona Experiment Station with a view to ascertaining quantitatively the destructiveness of prairie dogs to the stock range in northern Arizona and the principal forage types affected. Two sets of experimental inclosures were established, one near Coconino, in the wheat-grass forage type, and the other near Williams, in the blue-grama type.

The results of four years' experiments at Coconino show that prairie dogs destroyed 69 per cent of the wheat grass and 99 per cent of the dropseed, or 80 per cent of the total potential annual production of forage. In one year's experiments at Williams the rodents destroyed 83 per cent of the blue-grama crop, the most important forage grass of the region. These experiments were made under conditions where the vegetation is at present maintaining itself; in many areas the prairie dogs destroy 100 per cent of the forage and have to move out themselves. Such extreme destruction favors the growth of unpalatable weeds, makes range recovery difficult, and opens the way for soil deterioration through erosion. The prairie dog has not been shown to have a single beneficial food habit.

Returns from banded birds, 1920 to 1923, F. C. LINCOLN (*U. S. Dept. Agr. Bul. 1268 (1924), pp. 56, pls. 4, fig. 1*).—This bulletin presents facts relative to 1,746 returns received by the Biological Survey during the period from January 1, 1920, to June 30, 1923. The data are presented in tabular form without discussion.

A method of caring for and training homing pigeons, T. F. DEVLIN (*[Philadelphia]: Author, 1924, pp. 61, pl. 1, fig. 1*).—This is a small handbook.

Report of the entomologist [of the Florida Station], J. R. WATSON (*Florida Sta. Rpt. 1923, pp. 103-108, 110-113*).—The application of sprays for control of the Florida flower thrips, *Frankliniella tritici bispinosa* (Morg.), in citrus bloom demonstrated that the best time to spray is when the maximum number of blossoms are open. It was found that in groves where Spanish needles (*Bideus leucantha*) are allowed to bloom freely during the blossoming of citrus, spraying is of practically no benefit as the citrus blossoms are promptly reinfested from the weeds. The work emphasized the fact that there is much variation in the severity of the scarring on different varieties of oranges, varieties like the Pineapple, with a thin smooth skin, being most severely damaged. There is also much variation in the different areas of the citrus belt, the fruit of the Indian River region usually showing a higher percentage of severely marked fruit, even though the average number of thrips to the bloom is no higher than elsewhere. Dusting experiments with thrips on oranges in which a high-power duster was used indicated little in favor of this method of control. On the other hand, dusting with nicotine sulfate lime dusts was found both practical and the most economical method of dealing with thrips on Satsumas, their low-growing habit making it possible to use a hand duster of the bellows type and to direct a good blast into each cluster of blossoms, the work being just as efficient as that done with the spraying

machine and the cost much less. The distribution of this thrips was determined more accurately than heretofore, the limit of its range westward coinciding with remarkable closeness with the western boundary of Florida. Somewhere between Valdosta and Atlanta, this species replaced the northern flower thrips, *F. tritici* (Fitch).

In control work with rust mites in Lake County, dusting was fully as effective as spraying, and the cost was usually less than one-third that of spraying. In June the infestation of citrus groves by mealybugs was the severest in the last decade or more, and the use of oil emulsion sprays by many growers proved unsatisfactory, not over 50 per cent being killed. Lime sulfur applied with strong pressure, at least 250 lbs., penetrated better than the oil emulsions, and a 1 per cent solution of a good grade of carbolic acid did good work in many groves. Kerosene emulsion 1-15 also gave satisfactory results, but perhaps the most satisfactory solution was one consisting of 1 qt. of nicotine sulfate and 6 or 8 lbs. of soap to 200 gal. of water. Of the many predators which attack mealybugs, the predacious caterpillar *Laetilia coccidivora* was the most efficient check, having brought the pests under control in many groves. The dipterous parasite *Paraleptomastix abnormis* (Giard), introduced from California and widely distributed over the State, was discovered in a grove 8 miles from the one in which it was liberated in 1917.

Examinations made in a grove near Bradentown, where the ladybird beetle (*Delphastus* sp.) had been introduced from California, showed that there were no white flies to speak of except in one corner of the grove, and there the lady beetle was found. It has not been necessary to spray this grove for white fly during the last five or six years, but it has been sprayed for purple scale several times. A brief reference is made to the unusual abundance of aphids on citrus during the spring of 1923.

A new development of thrips injury during the spring is reported, being that of heavy damage of snap beans. The leaves were wrinkled and curled by their attack and frequently so badly injured that they fell. The greenhouse leaf-tyer was a source of much damage to late celery at Sanford in March and April. The most successful control measures tried consisted in the use of poisoned bran bait moistened with nitrobenzene, undiluted nitrobenzene giving the best results, the killing from one application being about 75 per cent. The garden fleahopper (*Halticus citri* Sahn.) was also injurious to late celery in the Sanford district. Calcium cyanide dust was found to control this pest the best of any of the insecticides tried. The Pee Dee strain of improved Spanish peanuts was particularly attractive to the flower thrips, being the only one of many varieties and strains seriously attacked.

An account of the bean leafhopper is given by Beyer, studies of which by this author have been previously noted (E. S. R., 48, p. 53). In field experiments conducted during the summer and fall of 1922, it was found that much of the effectiveness of dust depends upon the manner in which it is applied. The best results were obtained with the fan-type duster, as the knapsack bellows type produced more or less of an intermittent flow. The most satisfactory time to apply the dust is in the morning as soon as the dew begins to dry. A number of fillers were tested out, including kaolin, sulfur, and hydrated lime. The hydrated lime, with 10 per cent of dusting sulfur impregnated with 2.5 per cent nicotine, gave the best results as it was distributed most easily and uniformly. In spraying experiments, a Bordeaux mixture, 4-4-50, to which was added 1-1,000 nicotine sulfate, gave satisfactory results, the adults as well as the nymphs being killed when applied by a specially devised arrangement of inclosed nozzles.

Annual report of the State entomologist [Georgia] for 1922, I. W. WILLIAMS (*Ga. State Bd. Ent. Bul.* 64 (1923), pp. 10).—This is a brief account of investigation, inspection, and control work conducted in Georgia.

Annual report of the entomology department, R. W. HARNED (*Mississippi Sta. Rpt.* 1923, pp. 18–27).—Progress reports on three projects, by R. N. Lobdell, are included: (1) A systematic and biological study of the crawfish of Mississippi, in which it is stated that carbon disulphide has thus far proved to be the cheapest and most effective means for control; (2) a systematic and biological study of the scale insects of Mississippi, including a list of forms, 50 in number, collected in the State during 1922–23 (6 for the first time), the name, host, locality, and date of each being given; and (3) a systematic and biological study of insects affecting pecans.

Entomology [at the Pennsylvania Station], S. W. FROST and J. L. HOBSFALL (*Pennsylvania Sta. Bul.* 188 (1924), pp. 16, 17).—Studies conducted to determine the value and extent of the use of commercial and home-mix emulsions have shown that, of home mixtures, a formula consisting of 3 gal. of oil, 1.5 lbs. of Kayso, and 300 gal. of water gives a very stable mixture. The oil, Kayso, and a small amount of water were mixed by means of a bucket pump, forming a stock solution, and it was found that the oil would not separate from the stock solution even when left standing for several weeks. No burning was observed even when applied as late as the petal spray with the full dormant strength. The home-mix oil emulsions compare favorably with the commercial mixtures, comparison being made on the basis of the size of the oil globules and the ability of the oil to remain in an emulsion.

Nicotine dust consisting of 2 per cent nicotine sulfate dust with dolomite as a carrier, as well as 2 per cent nicotine sulfate dust with hydrated lime as a carrier, proved as satisfactory as nicotine sprays in the control of red bugs in the petal spray. Oil sprays gave no control in the dormant treatment, but in a delayed dormant killed a large percentage of the overwintering eggs. The home mixture used at the rate of 3 gal. of oil to 100 gal. of water did not give as good control of red bugs as the commercial mixtures.

Brief reference is made to the work with plant lice affecting truck crops, previously noted from earlier bulletins (*E. S. R.*, 50, p. 557; 51, pp. 253, 254). Reference is also made to extensive tests of corrosive sublimate, 1–1,000, for control of the cabbage root maggot, in which the standardization of the method of application has helped reduce the total cost of treatment to a minimum. Application of the material by the use of pails and homemade dippers has been found to be most satisfactory. The progress of control work with millipeds in cold frames is referred to.

[Economic insects in the County of Holland, England], H. W. MILES (*Kirton [Lincolnshire] Agr. Inst. Ann. Rpt.* 1923, pp. 43–51, fig. 1).—Summarized accounts are given of the mustard beetle (*Phaedon cochleariae* Fab.: *P. armoraciae* L.), which is most destructive to the mustard crop and is also found in vast numbers in fields of turnips and swedes in the County of Holland; of the diamond-back moth; and of the cabbage maggot.

Greenhouse insects, E. I. MCDANIEL (*Michigan Sta. Spec. Bul.* 134 (1924), pp. 75, figs. 41).—This is a practical summary of information on greenhouse insects and means for their control.

Nicotiana rustica as a source of nicotine for insect control, D. E. HALEY, F. D. GARDNER, and R. T. WHITNEY (*Pennsylvania Sta. Bul.* 188 (1924), p. 8).—Chemical studies have shown that the nicotine content of *N. rustica*, a high yielding and high nicotine tobacco, can be increased by topping or suckering the plants during their period of growth. The nicotine can easily be obtained

by pulverizing the plant and steeping in cold water, or heating the mixture to boiling and then filtering. Solutions obtained in this way, when diluted to a concentration of 0.06 to 0.2 per cent nicotine and with the addition of the proper amount of soap, possess pronounced aphiscidal properties.

The fungicide and insecticide guarantee, for what does it stand? E. A. McMAHON (*Pomol. and Fruit Growing Soc. Quebec Ann. Rpt. 1923, pp. 55-60*).—A discussion of the subject as applied to Canada, which is not yet protected through insecticide legislation.

The European earwig, B. B. FULTON (*Oregon Sta. Bul. 207 (1924), pp. 4-29, figs. 21*).—A detailed account of the European earwig (*Forficula auricularia* L.), based upon a review of the literature and investigations conducted by the author in Oregon, where the pest has been present since 1909. This insect is of particular importance on account of its disagreeable habit of concealing itself in and about houses, and it is also destructive to garden vegetables and flowers and occasionally a pest of bush and tree fruits.

No effective parasitic or predatory enemies of this pest have as yet been found in Oregon. The best method of control consists in the scattering about in the evening of a poison bran bait consisting of sodium fluoride 1 lb., molasses 2 qt., water 2 gal., and wheat bran 16 lbs. Clear wheat bran is recommended for use in baits scattered over the ground, and ground oat hulls for bait to be applied to trees, buildings, and other objects. If the control measures are applied when the majority of young begin to feed at night, it is believed that this brood and the adults can be poisoned before the second lot of eggs is deposited.

The bulletin includes a bibliography of 35 titles. Accounts of this insect in Rhode Island by Jones (*E. S. R., 38, p. 56*) and in the Northwest by Essig (*E. S. R., 39, p. 464*), Fulton, and Frank (*E. S. R., 49, p. 850*) have been noted.

The buckthorn aphid (*Aphis abbreviata* Patch), E. M. PATCH (*Maine Sta. Bul. 317 (1924), pp. 29-52, figs. 3*).—The author's investigations have led to the determination that a single species, *A. abbreviata* Patch, 1912 (*E. S. R., 28, p. 60*), which passes the winter in the egg stage on the branches of buckthorn (*Rhamnus* sp.), usually tucked about the leaf buds, produces winged forms in the spring that migrate to vegetable and flower gardens and weeds. The overwintering eggs on buckthorn hatch into females only, "the stem mothers" or first generation, which, without mating, produce a considerable brood of living young that also are all females, and which attain their full growth by feeding as did the parent form on the leaves of buckthorn. Some of this second spring generation are wingless, others winged, the wingless forms remaining on the buckthorn, while their winged sisters migrate to nasturtium, dock, potatoes, and a multitude of other plants, thence to disperse in later generations to still others. The wingless females of the second buckthorn generation produce chiefly young that become winged and follow their migrant aunts to summer food plants, where a succession of female generations are born, for the most part wingless but still with a fair proportion of winged forms, which serve to scatter the species to such different plants as meet the food requirements of the aphid. Late in the summer and in the fall two forms with a special mission are developed, one winged and known as the "fall migrant," and one wingless. The wingless females of this fall generation give birth to young that develop into winged males and fly to the buckthorn. The fall migrants have, previous to the flight of the males, already arrived at the buckthorn, where they give birth to very small egg-laying females, which attain their growth by the time the males appear. The life cycle of this aphid is graphically illustrated in diagrammatic form.

The economic importance of this aphid is considered by the author (1) as a nuisance to the landscape gardener, (2) as a pest in the vegetable garden, and (3) as a carrier of plant disease. In the vicinity of Orono it outnumbered the better known melon aphid as a cucumber and squash pest, while as a potato insect it is generally outranked throughout the State by the green peach aphid, and still more by the potato aphid. In 1923 it was found in a certain laboratory plot of potatoes at Presque Isle to outnumber the other two species combined. Experiments conducted in 1923 by E. S. Schultz and D. Folsom proved this species to be capable of mild mosaic transmission in potatoes. The summer food plants of this species observed in Maine in 1923, representing 29 families, are listed.

It is pointed out that the most effective control measure consists in the destruction of buckthorn. In situations where the destruction of buckthorn is not possible or desirable, a thorough spray the last week in September, followed by a second two weeks later, should kill the majority of the oviparous females and thus hold down the number of overwintering eggs. A spring spray, before the middle of June in Maine, should kill most of the spring aphids before migration to the summer food plants begins. Fumigation should be an even more effective method.

Details are given of the experimental work in which transfers were made from buckthorn to arrowhead, water plantain, and pickerel weed and from buckthorn to potato. Technical descriptions of the species in its several stages are included.

On the destroyer of lucerne, the pea leaf-louse, *Acyrtosiphon pisi* Klb. [trans. title], J. JABLONOWSKI (*Kísérlet. Közlem.*, 26 (1923), No. 1-4, pp. 8-15).—This is a contribution from the Royal Entomological Station at Budapest, Hungary. As a result of a long period of very dry and cold weather in the spring of 1921 in Hungary, the first crop of alfalfa was highly infested by pea aphids, which led to rotting of the roots and resulted in serious damage to the crop.

The cankerworms, B. A. PORTER and C. H. ALDEN (*U. S. Dept. Agr. Bul.* 1238 (1924), pp. 38, pls. 3, figs. 2).—This is a review of the present status of knowledge of the fall cankerworm and the spring cankerworm, which includes the results of studies conducted by the authors in the laboratory of the Bureau of Entomology at Wallingford, Conn., in cooperation with the Connecticut State Experiment Station. The account includes a list of 39 references to the literature cited.

The bud moth, B. A. PORTER (*U. S. Dept. Agr. Bul.* 1273 (1924), pp. 20, pls. 2, fig. 1).—This is a report of studies of the bud moth, officially known as the eye-spotted bud-moth, which were conducted in 1920 and 1921 at the field station at Wallingford, Conn., in cooperation with the Connecticut State Experiment Station. This insect is of European origin, having first been recorded from the United States by T. W. Harris in 1841, where it was presumably introduced with importations of nursery stock. It is a rather general feeder, attacking most of the deciduous fruit trees and some ornamental, shade, and forest trees, 17 food plants being listed. Its distribution extends over much of the northern part of the United States and southern Canada, from the Atlantic to the Pacific. Along the Appalachian Range it extends as far south as Georgia.

This bud moth has one generation every 12 months, commencing with the egg stage in midsummer and ending with the deposition of eggs in midsummer of the following year. Winter is passed as a partially grown larva in a tiny silken nest or hibernaculum placed in any convenient crevice or other place. Under Connecticut conditions, practically all larvae enter hibernation at the

end of the third stage and molt during the construction of the hibernaculum, although occasionally a few individuals pass the winter in the following stage. Upon emerging from winter quarters, early in the spring just as the buds are showing green or a little later, the larva makes its way to a bud and chews into it from the outside, or, if the leaves are unfolding, makes its way into the heart of a cluster, leaving little external evidence of its presence. After feeding for a short time, the larva constructs a tubular nest, usually in a fold or the curled portion of a leaf, sometimes between two leaves which touch.

It was found in the spring of 1921 that some of the larvae molt twice in the spring and others three times, except in the occasional instances when hibernation is delayed until the fifth stage, in which case the number of molts in the spring is one less than usual, making the number of stages six in some cases and seven in others. When ready to pupate, the larva sometimes remains in its feeding shelter and sometimes deserts this place, finding another sheltered spot in a curled leaf or elsewhere, and lines the place chosen with silk. Here, within a week, it pupates, the pupal stage varying from 12 to 21 days, with an average of 15 to 16 days. Oviposition commences from 2 to 5 days after emergence and continues for from 1 to 11 days, although most of the eggs are laid during the first 2 or 3 days. The maximum number of eggs recorded from a single female was 156. The incubation period of the egg is approximately 9 days under ordinary summer conditions in Connecticut.

At least five other species of bud moth, including the lesser bud moth, *Recurvaria nanella* (Hbn.); the rose leaf-tyer (oblique-banded leaf-roller); *Olethreutes chionosema* Zel.; the green bud-worm (*O. consanguinana* Wlsm.); and the leaf crumpler, winter in a similar manner and are likely at one time or another to be confused with the eye-spotted bud-moth. Reference is made to a number of insect predators and to numerous parasites reared from the pest, both in North America and Europe. What is thought to be a new species of *Secodella* was reared by the author in August, 1921, from the larvae.

A satisfactory degree of control is usually obtained by two of the usual routine spring spray applications, the pink cluster-bud application, to which arsenate of lead, 1 lb. of the dry form in 50 gal. of water, should be added, and the calyx spray, which is applied primarily for codling moth control.

A list of 23 references to the literature cited is included.

The clover-seed caterpillar (*Laspeyresia interstinctana* Clemens), L. P. WEHRLE (*New York Cornell Sta. Bul.* 428 (1924), pp. 3-34, figs. 13).—This is a report of biological studies of the pest officially known as the clover-seed worm, which causes serious injury to red clover in the Northeastern and Central States.

In the vicinity of Ithaca, where the author's studies were conducted from 1919 to 1923, there are two generations, with reason to believe that in favorable seasons a partial third generation may occur also. The flight of the moths of the first generation extends from late May or early June until late June or early July, and that of the second generation from late July or early August until about September 1. The incubation of the egg was found to require about 9 days, the larval stage to last about 30 days in the first generation and about 278 days in the second generation, and the pupal stage about 13 days in the first generation and about 19 days in the second generation.

The caterpillars feed at the crowns of the plants and in the heads. The overwintering cocoon is found under the leaf sheaths at the crowns of clover plants and on the ground under the plants. The cocoons may also be attached to other plants, such as sheep sorrel (*Rumex acetosella*), or formed within hollow stems, such as the straws of wheat. The cocoons may be found in the

field in late fall, in winter, and in spring. The number of instars in the specimens studied varied from four to six. In the vicinity of Ithaca the winter is passed as a larva in a silken cocoon, although there is reason to believe that some of the larvae may pupate in the fall.

Two hymenopterous parasites, *Phanerotoma tibialis* Hald. and *Bassus latincinctus*, were reared from the caterpillar at Ithaca. A bibliography of six pages is included.

Round-headed apple-tree borer (*Saperda candida* Fab.) and its control, C. E. PETCH (*Pomol. and Fruit Growing Soc. Quebec Ann Rpt. 1923, pp. 100-107*).—This summary of information on *S. candida* and means for its control includes a bibliography of 20 titles.

The rough-headed corn stalk-beetle, W. J. PHILLIPS and H. Fox (*U. S. Dept. Agr. Bul. 1267 (1924), pp. 34, pls. 4, figs. 16*).—This is a report of biological and morphological studies of (*Ligyru*) *Euetheola rugiceps* (Lec.), officially known as the sugar-cane beetle, conducted from 1914 to 1916, largely at Tappahannock and Charlottesville, Va.

The pest occurs in Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia. It hibernates in the soil as an adult in or near its normal feeding grounds and reappears with warm weather, which in Virginia is late April or early May. The adults begin to feed as soon as they leave their hibernating quarters, their normal food consisting of certain grasses, particularly those of the genus *Paspalum*, but should these plants be scarce they readily turn their attention to corn and may cause serious injury through their attack at the base of the stalks.

At Tappahannock oviposition was observed chiefly during June, the earliest eggs being found on June 5. The eggs are deposited a few inches below the surface of the ground wherever the beetles happen to be feeding, practically the entire existence of the pest being spent below ground. From two to three weeks are required for the incubation of the egg, and from six to eight weeks for the larvae to reach maturity, the full-grown larvae having been found at Tappahannock from August 2 to October 2, being most abundant the last week in August and the first week in September. The normal food of the larvae consists chiefly of decayed and disintegrated vegetable matter. About two weeks are spent in the pupal stage, the first pupa having been found in the field at Tappahannock on August 16 in 1915 and on August 12 in 1916, and the latest on November 2 in 1916. The adults of the new generation were found as early as August 24, but the majority appear the last half of September.

It is pointed out that the carrot beetle and *Dyscinetus trachypygus* (Burm.) are likely to be mistaken for this stalk beetle.

In addition to a number of birds, insects, and other predatory enemies, the species has two true parasites, one of which is the dextid fly *Megapariopsis opaca* Coq. and the other a hymenopteran closely resembling *Tiphia inornata* Say. All stages of the pest, more especially the larva and pupa, are subject to infection by the fungus parasite *Metarrhizium anisopliae*. The control measures recommended are the same as those given in Farmers' Bulletin 875 (E. S. R., 38, p. 263).

Studies of the Mexican bean beetle in the Southeast, N. F. HOWARD and L. L. ENGLISH (*U. S. Dept. Agr. Bul. 1243 (1924), pp. 51, pls. 12, figs. 16*).—This is a report of studies of the biology of *Epilachna corrupta* Muls. and of control measures conducted in 1921 and 1922, during the first year in cooperation with the Alabama Experiment Station.

It is pointed out that this pest is the most serious insect enemy of edible beans in the portions of the United States where it occurs, and that it has spread from Alabama into States as far north as Ohio and Virginia. Previous accounts of the pest by Hinds in Alabama, where the eastern outbreak originated, and by others have been noted (E. S. R., 37, p. 465; 45, p. 158; 47, pp. 56, 555; 48, p. 57.; 50, pp. 848, 849; 51, pp. 256, 363, 554). While primarily a pest of beans (*Phaseolus* spp.), the beetle is able to reproduce on beggarweed, cowpeas, soy beans, and a few other plants. In many instances it has severely damaged cowpeas and soy beans. Mention is made of a number of predacious enemies of the pest and of several parasites.

Since the bean plant is very susceptible to injury from arsenicals, care must be exercised in their use. The best results in its control have been obtained with magnesium arsenate applied as a spray at the rate of 2 lbs. to 100 gal. of water, or about 2 lbs. per acre on bush beans drilled in rows 3 ft. apart. This arsenical is safe for application to bean foliage and at the same time sufficiently toxic to kill larvae and some adults. Caseinate of lime may be used as a spreader at the rate of 1 lb. to 100 gal. of spray, about 90 to 100 gal. of spray per acre being required when applied at 150 lbs. pressure with a large machine which directs three nozzles to each row, one directed at the tops of the plants and two so that the spray will reach the under side of the leaves. When water facilities are lacking, good results may be obtained by the thorough application of a dust consisting of either 1 part of magnesium arsenate and from 1 to 5 parts of hydrated lime, depending on the numbers of beetles present and the damage done, or of 1 part of high-grade calcium arsenate and 9 parts of hydrated lime, applied to the under side of the leaves at the rate of about 15 lbs. to the acre. Similar results have been obtained from the use of a mixture of 1 part of dry calcium arsenate, 1 part of fine dusting sulfur, and 4 parts of hydrated lime. Treatment should begin as soon as the eggs of the bean beetle become numerous, from one to five applications being required, depending on the degree of infestation.

Seasonal management for commercial apiaries, R. H. KELTY (*Michigan Sta. Spec. Bul.* 135 (1924), pp. 3-58, figs. 29; *Sup.*, pl. 1).—Following a brief introduction, the subject is dealt with under the headings of spring management (pp. 6-19); management during the main honey flow, which includes discussions of the Demaree, Markham, and Miller plans and of queen rearing, increase, and extracting (pp. 19-45); management after the main honey flow (pp. 45-49); and preparations for winter (pp. 49-58). Drawings of the floor plan and arrangement of an extracting room, a cross section showing details of construction of a bee cellar, and a floor plan and arrangement of ventilators for a bee cellar are included. A beekeeper's guide for seasonal management, in chart form, prepared as a supplement to the bulletin, shows the relative bee population during the year, seasonal manipulation, etc.

Miscellaneous biological observations on bumblebees, O. E. PLATH (*Biol. Bul. Mar. Biol. Lab. Woods Hole*, 47 (1924), No. 2, pp. 65-78, figs. 2).—This is a report of further studies of the life history and habits of bumblebees (E. S. R., 50, p. 259) with a list of 41 references to the literature cited.

Ants [trans. title], G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 75 (1924), *Spanish ed.*, pp. 11).—This is a brief account of the importance of ants in Porto Rico, in which particular mention is made of the fire ant, also referred to as the brown ant, to the coffee shade-tree ant (*Myrmelachista ambigua ramulorum* Whlr.), and to the "albayalde" (*Wasmannia auropunctata* Roger), which attends mealybugs on citrus, sugar cane, etc.

Woolly aphid parasite, *Aphelinus mali* (Hald.), L. J. NEWMAN (*Jour. Dept. Agr. West. Aust.*, 2 ser., 1 (1924), No. 1, pp. 40-44, pls. 2, fig. 1).—The

author records the successful introduction of *A. mali* into Western Australia, where the woolly aphis thrives particularly well in the southwest and southern apple country.

Longevity of the fowl tick (*Argas persicus*), L. J. NEWMAN (*Jour. Dept. Agr. West. Aust.*, 2 ser., 1 (1924), No. 1, pp. 48, 49, fig. 1).—The author records four years five months as the maximum longevity of female fowl ticks under observation.

FOODS—HUMAN NUTRITION

Food products, H. C. SHERMAN (*New York: Macmillan Co.*, 1924, 2 ed., rev. and enl., pp. XII+687, figs. 44).—This is the second edition of this valuable reference book on the more important types of food, the general points covered being the production and preparation for market and relative economic importance; the approximate composition and general food value; questions of sanitation, inspection, and standards of purity; and special characteristics of composition, digestibility, nutritive value, and place in the diet. The present knowledge concerning the vitamins as factors in food values is summarized in the first chapter, and throughout the book the vitamins have been included in the discussion of the nutritive value of the different foods. A chapter has been added on the economic relationships of food products, with practical suggestions for household food budgets. Data on food legislation and inspection and tables on the composition of foods and the chief sources of vitamins A, B, and C are included in appendixes.

Chemistry in relation to food, G. W. MONIER-WILLIAMS (*London: Ernest Benn, Ltd.*, 1924, pp. 20).—This is a nontechnical pamphlet on the application of chemistry to the manufacture, distribution, and supervision of such typical foodstuffs as milk and its products, margarine, canned foods, flour and bread, baking powders and self-raising flours, and sugar, together with a general discussion of impurities in foodstuffs and their origin; preservatives, coloring matters, and essences; and nutrition problems.

Feeding the family, M. S. ROSE (*New York: Macmillan Co.*, 1924, rev. ed., pp. XIX+487, pls. 15, figs. 8).—In the revision of this well-known "guidebook to good nutrition" (E. S. R., 40, p. 361), the contributions of the past decade to the knowledge of vitamins, the quantitative requirements of calcium and phosphorus for children and adults, and the relative food value of different proteins have made possible a fuller interpretation of some of the dietary principles laid down in the first edition and have led to certain improvements in the special dietaries recommended, particularly food for the baby, for the sick and convalescent, and for the diabetic. The data reported in various tables have been brought up to date by cost changes, and a table of vitamin values has been added.

Foods and drugs, J. M. BARTLETT (*Maine Sta. Off. Insp.* 111 (1924), pp. 16).—This is the annual tabulation for 1923 of the results of the examination of food and drug samples collected by the inspectors of the division of inspection of the State department of agriculture (E. S. R., 50, p. 58).

Effect of storage on baking quality of common and durum wheats, C. E. MANGELS (*Cereal Chem.*, 1 (1924), No. 4, pp. 168-178).—The literature on the subject is reviewed, and data are reported on the change in the loaf volume of bread made from 12 samples of wheat grown in different sections of North Dakota in 1921 and stored for varying periods of time. Similar data on 8 samples of the 1922 crop are also reported. Data are included on the grade and moisture content of the different samples of wheat when received and the protein content of straight flour obtained from them.

Of the 1921 samples, four lots were hard red spring wheat and eight durum wheat. During the eight baking tests distributed over a period of two years the common wheats showed little change in loaf volume, with a slight tendency, if any, toward improvement. The results with the durum wheats were very variable. In general the volume tended to increase, but some samples showed a decrease. The results obtained with the 1922 samples were similar, but the differences between common and durum wheats were not so marked. That common wheat, although showing no change or slight improvement during two years of storage, does not retain its baking quality indefinitely was shown by the baking data on a sample of wheat from the 1909 crop tested at intervals up to 1922. From 1910 to 1916 the loaf volumes were remarkably constant, but the following year there was a decided loss in volume.

A comparison of warm (laboratory) and cool (elevator) storage on the baking qualities of straight flour is also reported. The flour was stored in December, 1922, and baking tests were made in March, June, and November, 1923. Warm storage proved more detrimental to flour quality than cool storage. After 11 months all of the lots showed some deterioration, which was greater for the durum flours than for the common wheat flours.

The cake flour laboratory, P. M. PATTERSON (*Cereal Chem.*, 1 (1924), No. 4, pp. 159-161).—This is a general discussion of the cake-making qualities of flour.

The factor considered of greatest importance is a uniformly fine condition of the flour particles. Another factor is the rupture point of the CO₂ bubbles, or the size to which the bubbles develop before they break. This depends upon a number of factors, including the texture of the flour and the nature and amount of the gluten. The ideal size is thought to be a diameter of $\frac{1}{16}$ in. The condition of the gluten has an important bearing upon the nature of the crumb. If the crumb is fairly dry and fluffy it shows that the emulsion has held until the cake has set, while if the crumb is waxy or greasy and the crust sugary the indications are that the emulsion has broken down, allowing the sugar to go into solution with the liquid while the fat has been absorbed by the starch particles.

The following formula is recommended as a test cake mixture: Sugar 175, shortening 75, egg albumin 5, powdered milk 15, salt 5, baking powder 10, and flour 225 gm., with water 250 cc. The baking powder used is a mixture of monocalcium phosphate 150, sodium pyrophosphate 50, soda 150, and flour or starch 50 gm. The sodium pyrophosphate is used with the monocalcium phosphate on account of the slower activity, which is desirable in a cake.

The digestibility of powdered dried meat, C. F. LANGWORTHY and A. D. HOLMES (*Nation's Health*, 6 (1924), No. 4, pp. 250, 251).—As determined by digestion experiments conducted in the usual manner, powdered dried meat made from extracted beef when furnishing 81 per cent of the total protein of a simple mixed diet had an average coefficient of digestibility of 92.3 per cent. None of the four subjects reported any physiological disturbances resulting from the ingestion of the powdered meat, which was made up into a soup with tomato purée.

Observations on the absorption of copper during the digestion of vegetables artificially coloured with copper sulfate (preliminary note), J. C. DRUMMOND (*Jour. State Med.*, 32 (1924), No. 8, pp. 382-386).—The question of possible harm resulting from the ingestion of small amounts of copper in artificially greened peas has been reinvestigated by experiments in vitro and in vivo, the main object being to determine whether copper is liberated in an absorbable form during the digestion of greened vegetables, and, if so, whether its absorption in small amounts over long periods is harmful.

In artificial gastric digestion experiments with ordinary dried peas and canned peas artificially colored with copper sulfate, it was found that a small amount of copper is capable of passing through a dialyzing membrane. Similar results were obtained in the vivo experiment conducted on a dog with a Payloff gastric fistula. To determine whether copper, if thus absorbed, is injurious to the system, rats were fed for a period of three months on a diet containing sufficient green peas to furnish 1.5 mg. of copper daily. No difference could be noted in the growth and general well-being of the rats in the control and copper groups, nor were any pathological conditions noted on autopsy.

Dietary sources of calcium and phosphorus, A. D. HOLMES (*Amer. Food Jour.*, 19 (1924), No. 10, pp. 455, 456).—The author has compiled, chiefly from data contributed by Sherman et al. in Bulletin 227 of the Office of Experiment Stations, U. S. D. A. (E. S. R., 24, p. 64), a table of the calcium and phosphorus contents of common food materials to serve as a guide to the proper selection of foods in connection with cod liver oil therapy. In explaining the correlation between the calcium and phosphorus of the food and the antirachitic vitamin of the cod liver oil, the former are likened to the building stones and the vitamin to the workmen. "Just as it is impossible for the workmen to build a house without the necessary building materials, so it is impossible for the antirachitic vitamin to stimulate the development of good bone structure unless the necessary bone-forming materials are available."

The value of egg yolk in supplementing diets deficient in calcium, E. Tso (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, pp. 410, 411).—It is reported briefly that on a diet composed of 30 parts by weight of fresh egg yolk and 70 parts of ground millet seed, the whole cooked with about its weight of distilled water for 15 minutes, young male rats have grown to an average weight of 260, and female rats to 170 gm. in 20 weeks. One female had a litter of 8 young, but none survived beyond the first week. On a control diet of equivalent proportions of fat, carbohydrate, and protein but consisting of 20 parts by weight of whole milk powder, 5 of butter, and 75 of millet seed, the young male rats grew to an average weight of 280 gm. in 20 weeks. On this diet one female gave birth to 7 young, all but 1 of which survived and reached an average weight of 22.6 gm. at the age of 18 days. The first of the diets used contained approximately 70 and the second 220 mg. of calcium in 100 gm. The ability of the first ration to promote growth to practically the same extent as the second is attributed to the special property of egg yolk of increasing calcium assimilation.

It is concluded that egg yolk when given in equivalent amounts in terms of caloric values is nearly as efficient as milk in promoting normal growth but is inadequate to meet the needs of lactation.

Regeneration of hemoglobin and diet factors in prolonged severe experimental anemia, G. H. WHIPPLE and F. S. ROBSCHT-ROBBINS (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 554-558).—The methods of determining blood regeneration used in the investigation of which this is a brief report are similar to those described in earlier papers (E. S. R., 44, p. 564), but the anemia, instead of being produced by two or three large hemorrhages, was kept at as nearly as constant a level as possible by frequent bleedings, the amount and number of which were determined by hemoglobin, hematocrit, and plasma volume determinations, the attempt being to maintain a constant hemoglobin level of from 40 to 50 per cent. The basal ration fed was one designed to be well balanced and yet to produce a minimal hemoglobin regeneration. This consisted of a bread made in the laboratory from the fol-

lowing ingredients: Wheat flour (bread) 12,000 gm., potato starch 6,000 gm., wheat bran 2,000 gm., sugar 4,000 gm., salt mixture (McCollum and Simmonds, minus iron citrate) 120 gm., cod liver oil 2,000 cc., canned tomato 2,000 gm., yeast (baker's cake) 454 gm., and water 7,500 cc.

With this basal diet the substances proving most valuable for hemoglobin production were liver and kidney. Beef heart muscle was more favorable than beef skeletal muscle, and salmon muscle of practically inert value. Egg yolk was more favorable than egg white, red blood cells, or hemoglobin. Brains increased hemoglobin production, and pancreas and thymus had no effect. Contrary to the results reported in the earlier study, inorganic iron in the form of Blaud pills had a distinctly favorable influence on hemoglobin production, but arsenic in the form of sodium cacodylate was quite inert. Ox and pig biles were without effect.

The energy metabolism of normal, full term infants, R. CONKLIN, M. E. MARSH, and J. R. MURLIN (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 553, 554).—In 234 observations of the respiratory metabolism of 50 infants under two weeks of age, the principal conclusions are as follows:

The respiratory quotient was lowest on the second day and gradually rose. The heat production per square meter of body surface was lowest on the fourth day, remained practically constant until the eighth day, and then rose. The average heat production for all the basal periods was 6.67 calories per hour per kilogram of body weight per hour 2 calories, and per square meter per hour 29.16 calories. Increases in heat production due to muscular activity went as high as 56 per cent in successive periods and 117 per cent in total variation for the whole series of observations on a single subject.

A photographic method for studying the growth and nutrition of children, H. D. CLOUGH (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, p. 422).—The method noted consists in making stereoscopic photographs of the subjects at three months' intervals. The apparatus, methods of taking the photographs, and interpretation of the results are discussed briefly.

A new feeding device for use with the experimental rat, H. T. PARSONS and N. ALEXANDER (*Jour. Lab. and Clin. Med.*, 9 (1924), No. 8, pp. 576-580, figs. 2).—The feeding device which is described and illustrated consists of a square metal box 2.75 by 2.75 by 2.5 in. provided with a sheet of 0.5 in. mesh wire cloth cut to fit smoothly inside the opening of the box and held in place over the food by means of heavy guide wires reaching to the bottom of the box. As a further precaution against scattering, the box is fastened to the side of the cage above the floor and against a galvanized metal sheet considerably larger than the side of the box.

Data are given on the amount of food scattered from this cup as compared with the open cup and the McCollum type of feeder suspended from the top of the cage. Vitamin B-deficient rations were used in each case, a low fat dry ration with the McCollum and the new feeding cups and a high fat paste ration with the other. The minimum wastage from the three types of cups was remarkably uniform, but the average and maximum figures were very much lower with the new device.

The blood platelets in rats on adequate and inadequate diets, D. N. SHULMAN and L. B. MENDEL (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 435, 436).—With the use of a method of platelet counting involving a minimum of manipulation and absence of contact of the drawn blood with possible coagulant surfaces, the authors have found the blood platelet count in normal albino rats to approximate 400,000 to 600,000 per cubic millimeter. The blood platelet count of rats on diets deficient in vitamin A differed but little from this average, an observation in agreement with that of Bedson and

Zilva (E. S. R., 51, p. 768) and in disagreement with earlier observations of Cramer, Drew, and Mottram (E. S. R., 49, p. 61).

[Studies on vitamin X] (*Abs. in Anat. Record*, 27 (1924), No. 4, pp. 203, 204).—Further studies on vitamin X (E. S. R., 51, p. 167) are reported briefly as follows:

Preliminary steps in the isolation and concentration of vitamine X, H. M. Evans and G. O. Burr.—On saponifying wheat germ oil at 30° C. with 20 per cent alcoholic potassium hydroxide, vitamin X is said to remain in the unsaponifiable fraction which comprises about 5 per cent of the total oil. From this it can be concentrated further by the use of such solvents as pentane, methyl alcohol, and petroleum ether to about 0.3 per cent of the original oil.

Stability and solubilities of the food substance or vitamine X required for reproduction, H. M. Evans and K. S. Bishop.—Beef muscle boiled for an hour and lettuce leaves autoclaved at 15 lbs. pressure for the same length of time did not lose their activity as a source of vitamin X. The vitamin has been found to be soluble in ethyl alcohol and ether but insoluble in water, thus placing it in the group of fat-soluble substances.

Proof of the power of the body to store the substance X required for reproduction, H. M. Evans and K. S. Bishop.—Evidence that the animal body has the power of storing vitamin X is reported as follows: Animals deprived of vitamin X retain their fertility for some time and then lose it. After being cured of sterility by diets rich in vitamin X they may continue through two succeeding gestations without it. A single large dose of vitamin X on the day of copulation has proved as effective as several small daily doses. Tissues of animals reared upon adequate foods have been found to contain vitamin X, and tissues of animals which have been reared upon X-free foods do not contain it.

The effect of methods of preparation upon the vitamin content of spinach, L. STANLEY and H. A. STILLMAN (*Jour. Home Econ.*, 16 (1924), No. 10 pp. 558-565, figs. 4).—In the experiments reported, spinach raw fresh, boiled fresh, steam cooked, home canned, commercially canned, and commercially dried, was used as the sole source of vitamins for young growing rats on a basal vitamin-free diet.

The minimum amount of the fresh raw spinach for normal growth of rats weighing from 60 to 100 gm. was 4 gm. daily and of the fresh spinach boiled for 30 minutes in an open kettle 5 gm. Normal growth was not obtained with the home-canned and steam-cooked spinach. Dried spinach was very unsatisfactory. In a series of experiments in which dried spinach was supplemented with orange juice, brewery yeast, and butterfat, respectively, the animals receiving orange juice and butter made the most rapid growth and those receiving yeast the least growth. This is thought to indicate that the dried spinach is deficient in both vitamin A and vitamin C, but contains vitamin B.

The basal metabolism in vitamin B deficiency, H. J. DEUEL, JR., and R. WEISS (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 456-458).—A brief report is given of the results obtained in a study of the basal metabolism, as determined in the respiration calorimeter, of dogs at various stages of vitamin B deficiency.

In one dog the metabolism was determined at approximately weekly intervals during the use of the standard vitamin B-deficient diet. In this animal the basal heat production fell at a rate to be expected from the decreased body weight resulting from lowered intake of food, but there was no evidence of any direct effect of the vitamin B deficiency on heat production. In another dog the basal metabolism at the height of polyneuritis was 25 per cent

higher than normal but fell to normal values after the removal of polyneuritic symptoms. The basal nitrogen elimination in this animal was three times as high during polyneuritis as after recovery. In a normal animal receiving an amount of vitamin B greater than that necessary for maintenance there was no alteration in basal metabolism.

It is concluded that vitamin B starvation does not alter the basal metabolism except when complicated with polyneuritis.

Studies on the chemistry of cod liver oil.—II, A cod liver oil concentrate manifesting both antirachitic and antiophthalmic properties, H. E. DUBIN and C. FUNK (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 458-460).—In this report on a continuation of the studies previously noted (E. S. R., 51, p. 312), the authors state that they have succeeded in preparing from cod liver oil "by means of a special extraction and a saponification process" a highly concentrated extract of both antirachitic and antiophthalmic vitamins. The crude concentrate, of which 0.5 gm. was obtained from 1,000 gm. of cod liver oil, is said to be a brown sirupy mass crystallizing in light yellowish brown needles radiating from a central point. These crystals are insoluble in water but soluble in ordinary organic solvents. On removing cholesterol the extract can be further concentrated to 0.1 gm.

It is stated that, while the exact chemical composition of the concentrate is unknown, the presence of carbon, hydrogen, oxygen, and sulfur and the absence of nitrogen, phosphorus, and the halogens have been demonstrated.

Clinical results in cases of rickets treated with an active concentrate prepared from cod liver oil, L. FISCHER (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 461, 462).—Favorable results are reported in the use of the concentrate noted above in the treatment of 37 cases of rickets in infants and children of the preschool age. The concentrate was first used in a sirup mixture and later in one grain tablets in which the concentrate was mixed with sugar, each tablet being equivalent to a half teaspoon of fresh cod liver oil.

Clinical experience with the active principle of cod liver oil, H. CHAPLIN (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 6, pp. 332, 333).—Evidence is summarized briefly that the concentrate of cod liver oil prepared* by the method described by Zucker (E. S. R., 49, p. 608) is potent against infantile as well as rat rickets.

Further experiments on the antirachitic action of yolk of egg, A. F. HESS and M. WEINSTOCK (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 441, 442).—In further studies on the antirachitic value of egg yolk (E. S. R., 50, p. 165), it has been found that as small an amount as 0.05 gm. daily is sufficient to protect rats on a phosphorus-deficient, rickets-producing diet, but on a calcium-deficient diet the protective value is not so great. The antirachitic value is not appreciably diminished by boiling the egg for 20 minutes but is reduced by drying the yolk and keeping it in a dried state. When given subcutaneously, the yolk was found to protect against rickets in daily doses of 0.15 gm. The nonsaponifiable fraction of the egg yolk was found to be protective, but it has not been determined whether or not the potency is restricted entirely to this fraction.

The prevention and cure of rickets by means of bile, R. KAPSINOW and D. JACKSON (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 472, 473).—It is reported that 7 cc. of fresh gall-bladder bile from the pig has prevented the development of rickets in rats on the low-phosphorus, rickets-producing diet of McCollum et al. (E. S. R., 46, p. 472) and that 1 cc. of the bile had a well-marked inhibitory action. Similarly, 7 cc. of the bile per day cured rickets in rats in 15 days.

The variation of complement of guinea pigs during scurvy, M. L. KOCH and A. H. SMITH (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, pp. 366-368, fig. 1).—It is noted that the complement titer of 12 guinea pigs during the progress and recovery of scurvy increased with the onset of scurvy and remained at somewhat higher values during convalescence. Inanition resulted in a lowering of the titer.

Studies of the physiological behavior of glyceryl tri-margarate (intarvin).—I, **Tests of the effects of intarvin, in successive generations of albino rats, when added to balanced natural diets, H. L. HEFT, M. KAHN, and W. J. GIES** (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 479, 480).—In two series of experiments which are still in progress rats have been carried into the third and fourth generation on diets in which from 5 to 12 per cent of the total daily food intake consisted of intarvin. It is stated that no difference could be detected in health and fertility between this group and a similar series in which an equivalent amount of lamb fat was used in place of intarvin.

The food value of intarvin, E. M. BENEDICT, W. S. LADD, M. L. STRAUSS, and R. WEST (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 485-487).—In an attempt to determine whether intarvin can actually be used in the body as a food, experiments were conducted on two diabetic patients and four normal subjects. It is of significance that the diabetic patients and two of the four normal subjects found the intarvin so distasteful that they were unable to eat enough to yield conclusive results. The other two subjects were placed upon a diet sufficient to maintain nitrogen equilibrium, and after a preliminary period of two days the carbohydrate and fat were shifted isodynamically to produce ketosis. On the fourth day of this diet intarvin was substituted for the bulk of the food fat. Daily determinations were made of the total nitrogen of the urine and of ammonia, total acetone bodies, organic acids, and the H-ion concentration of the urine.

The data thus obtained showed for the two subjects during the use of intarvin a protein-sparing action, a decrease in ketosis, and a lowering of the respiratory quotient indicating that a fat was being burned. Analyses of the feces showed that from 92 to 98 per cent of the food fat and of intarvin was absorbed.

In commenting on the difficulties of taking intarvin, it is noted that the most agreeable methods of taking it were to eat it dry and wash down with black coffee or to mix with scrambled eggs or with Roquefort cheese salad.

On the use of intarvin fat—glyceryl margarate—in diabetes mellitus, C. S. KEEFER, W. A. PERLZWEIG, and W. S. McCANN (*Bul. Johns Hopkins Hosp.*, 35 (1924), No. 403, pp. 265-270).—This investigation was conducted at the Johns Hopkins Hospital on four diabetic patients who were kept in the metabolism ward and given a weighed diet, with the substitution on certain days of intarvin for the bulk of the food fat. Analyses were made of the blood and urine and calculations of the amount and ratio of the foodstuffs consumed. With one exception no insulin was given during the period of observation.

The principal changes noted as the result of the use of intarvin were a definite decrease in acetone bodies in the urine of three of the four subjects on the days on which intarvin was fed, a slight increase in sugar excretion in two cases and decrease in the other two, no decrease in the CO₂ combining power of the plasma, and a decrease in the amount of organic acids excreted in three of the four cases.

The data are thought to support the view that intarvin is less ketogenic than ordinary fat, but from a practical standpoint the use of intarvin in diabetes is considered to be of little value on account of the fact that it is intensely dis-

agreeable to take. The intarvin was served hot so that it would be in liquid form and could be mixed with other foodstuffs such as coffee and broth. Nearly every one complained of the bad aftertaste of the fat, and nausea was experienced by several of the subjects.

Insulin, H. MACLEAN (*Nature* [London], 114 (1924), No. 2853, Sup., pp. 33-40, figs. 2).—In this lecture on insulin, the author discusses first the metabolism of foodstuffs in the body and changes in blood sugar under normal conditions and in diabetes, the difference between simple glycosuria and diabetes, and the chief symptoms and cause of diabetes. A brief historical account is then given of the discovery of insulin, followed by a discussion of its preparation, standardization, and use in diabetes, with predictions as to the future of insulin therapy.

The production of lactic acid in diabetes following the administration of insulin, E. TOLSTOI, R. O. LOEBEL, S. Z. LEVINE, and H. B. RICHARDSON (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 449-452).—Determinations are reported of the sugar, lactic acid, and inorganic phosphate in the blood of four diabetic patients before and between 1 and 2 hours after the injection of from 8 to 33 units of insulin. Respiratory metabolism determinations were also made in the respiration calorimeter, beginning from 15 to 75 minutes after the injection and continuing for 45 minutes. For purposes of comparison the blood of four nondiabetic subjects was analyzed before and one hour after the subcutaneous injection of from 15 to 25 minims of adrenaline.

In the diabetic subjects the invariable fall of blood glucose after insulin administration was not always accompanied by a rise in lactic acid. The production of lactic acid appeared to depend more upon the final level of blood sugar than upon its absolute decrease. The respiratory quotient was always higher after the insulin injection than before. In the normal subjects the rise of blood sugar following adrenaline was always accompanied by a lowering of the inorganic phosphates and a rise in the lactic acid. These results are thought to disprove the theory that insulin acts by converting glucose into lactic acid.

A table of standard diets for use in diabetes, R. PYBUS and D. M. LYON (*Brit. Med. Jour.*, No. 3321 (1924), pp. 326-329).—Standard diets for use in diabetes are given in tabular form and discussed. The diets are divided into four classes, as follows: Group A diets, for cases showing clinical signs of acidosis, contain a relatively large proportion of available carbohydrate and have a glucose-fat ratio of about 2:1. Insulin should always be employed with diets in this group. Group B diets are intended to desugarize the patient and have a glucose-fat ratio of 1:1. The diets in group C form an increasing series which are used to test the limit of the patient's tolerance, and those of group D are maintenance diets.

Thyroid enlargement in Michigan: The state-wide survey and preventive measures undertaken, R. M. OLIN (*Child Health Mag.*, 5 (1924), No. 7, pp. 295-298, fig. 1).—The scope and outcome of this survey have been essentially noted from another source (*E. S. R.*, 51, p. 668). In addition, it is stated that an agreement has been reached among all the salt manufacturers of the State to put on the market a table salt containing 0.02 per cent of sodium iodide and that an intensive state-wide publicity campaign has been instituted to secure the adoption of this salt in place of ordinary table salt.

The iodine content of Michigan water supplies, E. F. ELDRIDGE (*Amer. Jour. Pub. Health*, 14 (1924), No. 9, pp. 750-754, figs. 2).—In connection with the goiter survey noted above, determinations were made of the iodine content of the water supplies of the State, particular attention being paid to ground waters. The method of iodine determination employed was a modification of

the technique described by Dubiel, in which the iodine set free by the action of potassium permanganate and concentrated sulfuric acid is shaken out with carbon disulfide and the color compared with a standard solution in a Duboseq colorimeter. A 50-liter sample is used for each determination, the evaporation to small volume being conducted in open pans. If the chlorine content of the water is over 70 parts per billion the concentrated solution undergoes a preliminary extraction with alcohol. If bromides are present the brown color imparted to the carbon disulfide is removed by adding a weak solution of potassium thiocyanate.

None of the surface waters, except those of the Great Lakes, showed any iodine, nor was any iodine found in the ground water supplies of the upper peninsula and the upper part of the lower peninsula. The greater part of the remainder of the State had up to 2 parts per billion and a restricted area from 2 to 5 parts or above 5 parts per billion. The iodine content of wells at Mount Clemens averaged 24 parts per billion, and the mineral water from the same place 3,100 parts per billion.

It is concluded that the chief source of iodine in Michigan is the salt deposits underlying the various parts of the State.

Experimental relation of the bacteria of the paratyphoid-enteritidis group to poisonings by food, J. C. GEIGER, E. DAVIS, and H. BENSON (*Amer. Jour. Pub. Health*, 14 (1924), No. 7, pp. 578-584).—The specific questions considered in this study were the growth of paratyphoid-enteritidis organisms in preserved food, the chemical and physical changes taking place in food contaminated with these organisms, and the production and nature of the toxic filterable substances. Containers of commercially canned vegetables, meat, milk, and fruit products were opened aseptically and inoculated with two strains each of the various organisms of the paratyphoid group, *Bacillus enteritidis* and *B. vulgaris*, and were then resealed, shaken thoroughly, and incubated at 37° C. for 10 days, after which the cans were opened and the contents used for bacteriological counts and for feeding experiments with rabbits.

An increase in growth of the specific organism took place in every can inoculated, the growth being greatest in the vegetables and least in the fruit products. In some cases there was a marked change in the appearance of the contents and in others not. In the animal experiments, symptoms of diarrhea after feeding the unfiltered material were noted, once in the *B. paratyphosus* C series, twice in the *B. paratyphosus* B, and eight times in the *B. paratyphosus* A. Only two instances of diarrhea were noted after the filtered materials were fed.

A comparison of the pH values of the material before and after incubation having shown varied but consistent changes for each food regardless of the organism, a further study was made of the changes in the H-ion concentration of different media when inoculated with the various organisms. In dextrose sugar broth with a pH value of 7.2 incubated at 37°, a change in pH occurred immediately after inoculation, the greatest decline taking place after 3 hours and continuing for about 24 hours, when a pH value of from 5 to 4.5 was obtained. Similar results were obtained with dextrose sugar broth buffered with sodium hydrogen phosphate. Beef heart medium showed a strong buffer effect, and in this medium growth was not impaired. In dextrose broth the cultures were sterile after incubation for 10 days at 37°. In the media in which the change was most rapid the organisms ceased to grow, while in the media showing buffer properties growth was not affected. Similarly, in the canned foods which underwent very little change in pH values there was a corresponding increase in growth and change in physical appearance.

In a further study of the production of toxic substances by the various members of the paratyphoid-enteritidis group, four different media were inoculated with different strains, incubated for varying periods of time, and filtered, and the filtrates tested for toxicity for mice. The media used were 1 per cent dextrose broth pH 7.3, sugar-free broth pH 7.5, beef heart pH 7.6, and preserved ripe olives pH 6.6 to 6.8. The production of poisonous filterable substances was extremely variable. The instances of production of toxic substances by strains of *B. paratyphosus* B were double those produced by *B. paratyphosus* A and triple those by *B. paratyphosus* C. In only one instance out of 23 did strains of *B. enteritidis* produce a filterable poisonous substance. Dextrose broth proved the best medium for the production of poisonous filterable substances.

ANIMAL PRODUCTION

Animal nutrition, T. B. Wood (*London: Univ. Tutorial Press, 1924, pp. VIII+226, figs. 4*).—This book deals with the principles of animal feeding, including chapters on the use of the different nutrients in nutrition, the digestibility and feeding value of foodstuffs, and the calculation of rations for the different classes of livestock.

Some chemical characteristics of soft corn, A BUSHEY (*South Dakota Sta. Bul. 210 (1924), pp. 713-718, figs. 3*).—Samples of corn were taken for analysis on October 17 from fields frosted on October 3, 1923, and the analysis compared with normal corn. It was concluded from this test that frosted corn contains a higher content of ash and crude fiber, a similar total crude protein and starch content, and a varying content of ether extract. Some changes in the amounts of the different proteins were, however, observed. Soft corn is apparently high in amide, albumin, and globulin nitrogen and low in glutelin, with a variable zein content. Similar changes in the protein analysis of corn were also produced by a hailstorm.

Composition of sugar-beet pulp and tops and of silage therefrom, S. F. SHERWOOD (*U. S. Dept. Agr., Dept. Circ. 319 (1924), pp. 12*).—Chemical analyses of 25 samples of beet pulp, 5 samples of beet pulp silage, 22 samples of beet tops, and 18 samples of beet top silage collected in various States are given as follows:

Composition of original fresh products

Product	Water		Ash		Protein	
	Average	Variation	Average	Variation	Average	Variation
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Beet pulp.....	90.99	81.84-96.4	0.38	0.20-0.67	0.90	0.46-1.72
Beet pulp silage.....	90.48	88.74-92.54	.61	.35-.72	1.38	1.11-1.81
Beet tops.....	74.80	59.72-86.77	6.36	2.89-10.90	4.03	2.53-8.54
Beet top silage.....	66.82	51.03-78.70	13.96	8.05-20.86	3.73	1.57-7.79

Product	N-free extract		Crude fat		Crude fiber		Total apparent sugars	
	Average	Variation	Average	Variation	Average	Variation	Average	Variation
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Beet pulp.....	5.73	1.77-11.88	0.05	0.02-0.14	1.95	1.00-3.80	0.06	Trace-0.13
Beet pulp silage.....	3.95	2.96-5.06	.18	.08-.37	3.40	2.39-4.59	Trace.	Trace.
Beet tops.....	11.81	5.96-17.78	.26	.15-.68	2.78	1.24-5.41	4.02	1.11-8.00
Beet top silage.....	11.28	5.86-23.56	.44	.22-.89	3.78	2.24-7.19	1.03	Trace-4.25

It is pointed out that the large amounts of dirt on the beet tops reduced the feeding value nearly half.

Silage investigations conducted under the direction of the feeding section of the German Agricultural Society [trans. title] (*Arb. Deut. Landw. Gesell.*, No. 323 (1923), pp. X+117).—The results of German studies carried on from 1916 to 1921 of the changes in the chemical composition of the grasses through preservation in silos are reported in this series of papers. The results of a few feeding experiments are also given, but most of the work is based on the relation between the amounts of the nutrients put into the silo and the amounts recovered. The American and Swiss methods of preserving silage are compared.

The series of papers is as follows: Silage Investigations at the Gutenfeld Experimental Farm, by Hansen (pp. 1-33); Silage Investigations in the American Silo and Silage Investigations in the German Tower Silo, both by W. Zielstorff (pp. 34-74); The Loss of Meadow Grass in Crude and Digestible Nutrients, by W. Völtz and W. Dietrich (pp. 75-94); On the Loss of Nutrients in Meadow Aftermath through Ensiling, by W. Völtz and J. Jantzon (pp. 95-98); Silage Investigations with Different Green Feeds in 1918, by D. Meyer (pp. 99-112); Silage Investigations in the Lauchstädt Experiment Station, by W. Schneidewind (pp. 113, 114); and Silage Investigations, 1918-19, by Richardsen (pp. 115-117).

Commercial feeding stuffs, 1923-1924, J. M. BARTLETT (*Maine Sta. Off. Insp.* 112 (1924), pp. 17-36).—This consists mainly of a table containing the guaranties and analyses of the samples of feeding stuffs collected for official inspection between July 1, 1923, and July 1, 1924. The previous report was noted (*E. S. R.*, 50, p. 268).

Nebraska feeders' day, W. W. DERRICK (*Breeder's Gaz.*, 85 (1924), No. 24, p. 734).—The results of a third year's trial dealing with the economy of feeding 3-, 2-, and 1-year-old steers and calves are reported from the Nebraska Experiment Station in continuation of those previously noted (*E. S. R.*, 49, p. 772).

The results were in general in accord with those of the previous tests. The following amounts of feed were required per 100 lbs. of grain by the steers of the different ages: Calves 577 lbs. of corn and 200 lbs. of alfalfa, yearlings 755 lbs. of corn and 262 lbs. of alfalfa, 2-year-olds 864 lbs. of corn and 281 lbs. of alfalfa, and 3-year-olds 904 lbs. of corn and 317 lbs. of alfalfa. The older steers, though making less economical gains, gained more rapidly and were in marketable condition sooner than the younger cattle.

In tests of rations for baby beef production, calves fed shelled corn, silage, and alfalfa hay were the most economical producers. In experimental work with hogs, a ration of corn and tankage was found to be more economical than one of corn and alfalfa. Yellow corn fed with tankage also showed a slight advantage over white corn. No advantage in adding minerals to a ration of corn and tankage was evident in other trial.

In comparing rations for lambs, shelled corn, alfalfa hay, and the medium ration of linseed oil meal proved most profitable. Prairie hay was less efficient than alfalfa. Heavy feeding of oil meal increased the cost of grains. In a test of shearing lambs during the feeding period, it was found that sheared lambs made higher daily gains, but returned less profit at marketing than unsheared lambs.

Cooperative experiments upon the protein requirements for the growth of cattle, II, E. B. FORBES ET AL. (*Bul. Natl. Research Council*, 7 (1924), No. 42, pp. 44).—This is a report of further cooperative experiments (*E. S. R.*,

46, p. 764) dealing with the protein requirements of calves. The investigations conducted included three at the Pennsylvania Experiment Station, two at the North Dakota Station, and one each at the South Dakota, Maryland, and Nebraska Stations.

The general plan of the experiments was similar to that noted in a previous report. The calves were old enough to consume exclusively dry feeds. Two kinds of rations composed of the same feeds in each ration were tested. The one ration was designated as the high protein ration and was calculated to supply sufficient protein to conform with the current feeding standards, and the other or low protein ration was calculated to supply little more than the minimum amount of protein theoretically required. The energy and bulk of the rations were equalized by straw and starch. The amount of protein in each ration was made up from the following feeds in the proportions stated: Alfalfa hay 30 per cent, corn meal 10, linseed meal 25, and high grade peanut meal 35 per cent. The protein and energy supplied per 1,000 lbs. live weight in the different experiments were based on a given standard, depending on the age of the calves, so that the feeding was as near uniform at the different stations as possible.

The results were measured by nitrogen balances and by the live weights and measurements, all of which are tabulated and discussed separately from each station. Due to the variability in the results and methods of measurement employed, they could hardly be grouped for a summary. The growth made by several of the calves receiving the low protein rations was so good as compared with the estimated normal growth that the authors concluded, in harmony with the conclusions in the first report of these cooperative experiments, "that greater economy of protein intake than as suggested by this [Morrison] standard would be practicable." The brevity of the digestion experiments seemed to interfere with the value of the results as indications of the protein requirements for growth in calves.

[Experiments with beef cattle at the Mississippi Station], E. BARNETT (*Mississippi Sta. Rpt. 1923, pp. 12-14*).—Experiments conducted during 1922-23 are briefly summarized.

Winter rations for breeding cows.—Mature breeding cows have been successfully wintered for an average of 100 days on a ration of 2 lbs. of cottonseed meal, 32.5 lbs. of corn or sorghum silage, and 5 lbs. of Johnson grass hay. These cows made average gains during this period of 35 lbs. per head.

Winter rations for steer calves.—Fifteen steer calves averaging 463 lbs. made average gains of 100 lbs. during a 101-day winter feeding experiment on a ration of 1 lb. of cottonseed meal, 2 lbs. of corn, 1 lb. of either wheat bran or shorts, 20 lbs. of corn or sorghum silage, and 5 lbs. of hay.

Marketing calves v. yearlings.—In this experiment, it was found much more profitable to finish calves as yearlings than to sell them as calves.

Finishing beef steers.—A lot of steers receiving 2.5 lbs. of molasses daily per 1,000 lbs. live weight in addition to about 6 lbs. of cottonseed meal and corn silage made more economical gains than other lots receiving 5 lbs. of molasses or no molasses, though the larger amount of molasses produced better gains and a better finish. Scouring during the last 2 weeks of the 120 days set this lot back somewhat.

Report on the cattle-breeding operations in the Central Provinces and Berar for the year 1922-23, S. T. D. WALLACE (*Cent. Provs. and Berar [India] Dept. Agr., Rpt. Cattle Breeding Oper. 1923, pp. 19*).—This consists of a general report of the cattle breeding operations in the Central Provinces and Berar for the year 1922-23, including reports of progress at the Telinkheri

Dairy Farm and the Raigarh Cattle-breeding Farm for the year ended March 31, 1923.

Beef on the farm—slaughtering, cutting, curing, W. H. BLACK and E. W. MCCOMAS (*U. S. Dept. Agr., Farmers' Bul. 1415 (1924), pp. II+34, figs. 49*).—This consists of directions for killing, dressing, cutting, and curing beef under farm conditions.

Cross-breeding Merino ewes with mutton rams, W. L. HENNING (*Pennsylvania Sta. Bul. 188 (1924), p. 12*).—In studying the comparative returns from a flock of grade Merino ewes, it was found that more profit resulted when such ewes were bred to a mutton ram and the lambs marketed than when bred to fine wool rams.

Docking and castration of lambs, A. A. MACMILLAN (*Canada Dept. Agr., Livestock Branch Pamphlet 46 (1924), pp. 4, figs. 5*).—Directions are given and the advantages to be obtained are discussed for castrating and docking lambs.

Pig feeding experiment, J. M. SCOTT (*Florida Sta. Rpt. 1923, pp. 8, 25, 26*).—The gains made by four lots of 10 pigs each, averaging 100 lbs. in weight, were compared when fed during a 90-day test on the following rations: Lot 1 shelled corn only; lot 2 shelled corn, tankage, and peanut meal (20 : 1 : 1); lot 3 shelled corn and tankage (10 : 1); and lot 4 shelled corn and peanut meal (30 : 4). The average daily gains per head made by the respective lots during this test were 0.090, 0.888, 0.874, and 0.381 lb.

[Experiments in fattening swine at the Pennsylvania Station], M. F. GRIMES (*Pennsylvania Sta. Bul. 188 (1924), pp. 12, 13*).—The results of comparative feeding experiments with swine are reported, two of which are continuations of those previously noted (*E. S. R. 50, p. 469*).

By-products for fattening swine.—The comparative rations and the average daily gains made on each were as follows: Corn and tankage (10 : 1) 1.32 lbs. gain; corn, molasses, and tankage (7.5 : 2.5 : 1) 1.1 lbs. gain; stale bread and tankage (10 : 1) 1.26 lbs. gain; and stale cakes and tankage (10 : 1) 1.28 lbs. gain. The most uniform finish occurred in the lots receiving corn and tankage and stale cakes and tankage. The test lasted 85 days, and the pigs had access to rape pasture.

Protein supplements to corn for fattening swine.—In a comparison of various protein supplements to corn when self-fed, it was found that fish meal, pea-size oil cake, and tankage produced almost equal gains, the slight advantage being in the order named, with fish meal producing the best gains. Oil meal was decidedly inferior to the above-mentioned supplements.

Winter rations for brood sows.—This consists of a comparison of tankage, fish meal, alfalfa hay, and oats and middlings as supplements to corn for wintering brood sows. The alfalfa hay was of poor quality and the sows receiving it did not do so well as the other lots, which showed no significant differences in their gains.

Rice polish versus corn, E. BARNETT (*Mississippi Sta. Rpt. 1923, pp. 14, 15*).—In continuing this experiment (*E. S. R., 49, p. 469*), the hogs on rice polish did so poorly after 56 days that it was found necessary to replace it by corn for the completion of the test. The pigs used in this case averaged only 56 lbs. as compared with 94 lbs. in the previous experiment, which may account for the contradictory results obtained.

Soft pork studies, J. M. SCOTT (*Florida Sta. Rpt. 1923, pp. 8, 21-25*).—In continuing the soft pork investigations (*E. S. R. 49, p. 873*), the melting point was determined of samples of fat taken from 12 sows and 5 boars on June 28 and December 6, 1922. These pigs were all descended from 3 sows and 1 boar, and had been raised on the same ration of corn and shorts with a little

whole milk. The results show marked differences in the melting point of the fat of pigs of the same litter. The melting point became higher with advancing age in the same pigs, but marked differences in the amount of hardening of the fat were evident for individuals, the maximum change in the melting point during the interval of taking the two samples being 9.1 and the minimum 1.9° C. Losses of the offspring of the tested animals as well as 2 sows and 1 boar have handicapped the experiment, but it is being continued.

Tests of the melting point of samples of fat furnished by Armour and Company from pigs produced in the Northern States indicated softness in these hogs as well.

Iron deficiency in pigs, J. P. McGOWAN and A. CRICHTON (*Biochem. Jour.*, 18 (1924), No. 1, pp. 265-272).—The results of an experiment are reported from the Rowett Research Institute, Aberdeen, in which 2 sows were fed on a ration poor in iron during the last few weeks of pregnancy and during lactation. The average daily rations consisted of 2 lbs. of corn, 1 lb. of whitefish meal, and a full feed of distiller's draff. In addition to this, 1 sow received 40 gm. of ferric oxid, well mixed with the feed, per day. The sow receiving the ferric oxid farrowed 10 pigs and the other sow farrowed 8 pigs. Three from the latter litter were transferred with 4 from the former. All but 3 of the pigs suckling the sow receiving no iron, died within 54 days, and 1 of those not dying was killed as it turned out to be a runt. All the pigs suckling this sow showed symptoms of iron deficiency except 2, which were killed by the sow within 5 days of birth. Of the pigs suckling the sow receiving the iron supplement, all were raised and only 2 showed a trace of symptoms of iron deficiency.

The hemoglobin of the blood was estimated at from 60 to 80 per cent for all pigs at birth, and this amount was maintained with an erythrocyte count of 4 to 6 million per cubic millimeter by the pigs suckling the sow receiving the ferric oxid. On the other hand, the hemoglobin of the blood fell below 50 per cent within the first 2 weeks and remained there in most cases, with a red blood cell count of less than 3 million per cubic millimeter for the pigs on the sow receiving no iron supplement.

The authors discuss the sources through which the iron was obtained by the young pigs, and they seem to believe that it was probably obtained from the scattered feed or from the feces of the sow rather than through the milk, though no satisfactory analyses of the iron content of the milk were made. The symptoms of iron deficiency in pigs have been described in an earlier paper (E. S. R., 50, p. 172).

Cotton seed meal poisoning, J. P. McGOWAN and A. CRICHTON (*Biochem. Jour.*, 18 (1924), No. 1, pp. 273-282).—In studies of the relation between cottonseed meal poisoning and iron deficiency, 5 lots of 4 pigs each about 9 weeks old were fed over a period of about 3 months. Pens 1 and 2 received full feeds of a mixture of 4 lbs. of cottonseed meal and 12 lbs. of corn, with the addition of 40 gm. of ferric oxid in pen 2. Pen 3 received a ration of 12 lbs. of corn and 4 lbs. of peanut meal, while pens 4 and 5 received a proprietary mixture consisting of middlings, locust bean meal, palm kernel meal, peanut meal, and treacle, with the addition of a salt mixture containing a slight excess of iron in pen 4.

The pigs in pens 3 and 5, on the rations not containing additional iron, showed symptoms of iron deficiency practically the same as the symptoms shown by the pigs on the cottonseed meal ration without iron. The pigs on this ration ceased growing in a short time and apparently lost their appetites, though no hemoglobin deficiency was evident. Pen 2 made fair growth from

the beginning of the experiment on February 17 to the end on May 12. The pigs on the peanut and corn meal ration showed the typical symptoms of the iron deficiency and also a reduction in the hemoglobin titer to less than 45 per cent in 3 of the 4 pigs. In the pens in which the proprietary grain mixture was fed, those receiving the salt mixture made fairly good gains and appeared normal, while those not receiving the salt ceased to gain in a short time and 2 died in less than 2 months.

The authors conclude from the results of these experiments that cottonseed poisoning is not due to a toxic substance in the cottonseed meal, but rather to an iron deficiency in the entire ration, or other deficiencies of the diet which may have been aggravated by an iron deficiency in the diet of the suckling pig.

Care and management of farm work horses, J. O. WILLIAMS and E. B. KRANTZ (*U. S. Dept. Agr., Farmers' Bul. 1419 (1924), pp. II+18, figs. 15*).—This is a practical discussion of methods of care, feeding, and management.

Corn versus oats for work mules, E. A. TROWBRIDGE (*Missouri Sta. Circ. 125 (1924), pp. 4, figs. 2*).—Two pairs of mules were used for comparing oats and corn when fed with mixed timothy and clover hay. One mule of each team received oats while the other received corn for 364 days, after which the rations were reversed for an equal period. Both rations maintained endurance for hard work equally well and there was no difference in the residual effects on the animals. The corn-fed mules gained an average of 18.5 lbs. in a 364-day period, while those receiving oats lost an average of 2 lbs. each. The oat-fed mules ate an average of 145 lbs. more grain and 75 lbs. more hay in the same period than the corn-fed mules. Slightly more work (100 hours) was done by the corn-fed mules, due to the disability of the oat-fed mules from lameness or other causes.

The origin of the Shepherd dog, A. TRACY (*Jour. Heredity, 15 (1924), No. 4, pp. 146-165, figs. 18*).—The evolution of the Shepherd dog, the history of the breed, and its description and uses are discussed.

[Poultry experiments at the Mississippi Station], E. P. CLAYTON (*Mississippi Sta. Rpt. 1923, pp. 38-45*).—The results of two experiments in comparing cottonseed meal, beef scrap, skim milk, and no additional protein as sources of protein for laying hens are tabulated. The basal ration consisted of prepared grain, corn meal, wheat bran, and wheat shorts. The cottonseed meal and check pens were more regular in their egg production as it was impossible to get skim milk and beef scrap during a part of the test, at which time the egg production of these two lots diminished to almost nothing. The average rate of egg production was 23 and 33 per cent for the cottonseed meal and check pens and 16 and 18 per cent for the skim milk and beef-scrap pens.

The average number of eggs produced and feed consumed during 1921 and 1922 by Rhode Island Reds, Barred Rocks, White Leghorns, and Brown Leghorns are tabulated for comparison.

A 15-day comparison of skim milk, beef scrap, and shrimp meal as sources of protein for growing chickens in addition to a basal ration of corn meal and wheat bran 3:2 indicated the superiority of skim milk. The relative rates of gains by 20 birds during the test were 9.25 lbs. for the skim-milk pen, 1.5 lbs. for the beef-scrap pen, 2.25 lbs. for the shrimp-meal pen, and 1.25 lbs. for the check pen, which included 26 chicks.

[Experiments with poultry at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 188 (1924), pp. 24-26*).—Brief results are given of the following experiments:

The effect of artificial illumination on Single Comb White Leghorn pullets, P. T. Kistler.—In an experiment conducted from October 29, 1922, to October

27, 1923, two lots of hens having artificial light in the morning during the winter months, so that a 13.5-hour day was maintained, produced an average of 10.7 more eggs per bird during the first 16 weeks than two other pens receiving no light. From the seventeenth to the thirty-second week the production was practically equal, while the unlighted pen produced an average of 12.8 more eggs per bird from the thirty-third to the fifty-second week. There was little difference in the calculated returns from the lighted and unlighted pens.

The effect of various sources of animal protein on the egg production and condition of pullets, P. T. Kistler.—The results of one year's production in one experiment and the first 28 weeks' production in another experiment to compare various sources of protein for laying hens are tabulated. The preliminary results indicate a high egg-producing value for milk products, as well as a high feed cost. The possible economical utilization of vegetable proteins with mineral supplements is also suggested.

To compute the cost of raising a pullet from hatching to maturity (laying age), M. H. Brightman.—In collecting data on the cost of raising a pullet to maturity, it was found that 60.2 per cent of the 26,182 eggs set hatched chicks. The raising of the pullets has not yet been completed.

The research program of the department of poultry husbandry, W. C. THOMPSON (*New Jersey Stat. Hints to Poultrymen*, 13 (1924), No. 1, pp. 4, fig. 1).—This is a popular though brief discussion of research projects in poultry husbandry under way at this station.

The effects of adding vitamin-rich substances to normal rations for poultry.—I, *The fat soluble vitamin or vitamin A*, J. B. ORR, A. CRICHTON, ET AL. (*Scot. Jour. Agr.*, 7 (1924), No. 3, pp. 266-277).—The results of cooperative experiments conducted at four different institutions in Scotland, dealing with the vitamin requirements of poultry for growth, laying, and hatching of the eggs, are reported. Three experiments dealt with the growth of chicks.

Two lots of 6 Leghorn chicks each were fed in cages without access to sunlight at the Rowett Institute under the direction of B. M. North. The basal ration fed to both lots consisted of corn, bran, oatmeal, fish meal, and bone meal, with oats and wheat as a scratch feed. Limestone and water were always available, and 2 cc. of swede juice was given per bird daily. One pen received 5 cc. of cod liver oil per bird per day, while the other received an equal amount of linseed oil. During the 90 days of the experiment, the pullets receiving the cod liver oil made average daily gains of 8.6 gm. and the others 10.7 gm. The cockerels in the respective pens made average gains of 13.1 and 12.3 gm. per day.

An experiment at the East of Scotland College of Agriculture was similarly conducted by H. Newbigin with 2 lots of 10 Anconas each. These birds, however, were kept outside on the bare earth, and the amounts of cod liver oil and linseed oil were reduced to 1 cc. per bird daily. The average gains in both lots to 230 days of age were 5 gm. per bird.

A third experiment was similarly conducted at the West of Scotland College of Agriculture by A. Kinross, except that 3 lots of 70 White Leghorns were used and the oils were fed in amounts starting with 0.2 cc. and rising to 0.5 cc. per bird. Lot 3 received no oil. The average daily gains for the 3 lots during 48 days were 6.5, 6.9, and 7 gm., respectively.

Five egg-laying experiments were carried on to determine the value of adding cod liver oil to the rations of laying hens.

In an experiment at the Rowett Institute under the direction of M. Moir, 4 pens of White Leghorn pullets received a basal ration of bran, sharps, crushed oats, ground corn, and fish meal, with wheat, oats, and corn as the

scratch feed. One lot was supplied with 5 cc. of cod liver oil daily, another lot with an equal amount of linseed oil, and 2 lots received no oil. The average egg production per bird during the months of April, May, and June was for the lot receiving cod liver oil 47.6, for the lot receiving linseed oil 53, and for the two lots receiving no oil 53.2 and 52.1 eggs.

In a similar experiment at the North of Scotland College of Agriculture conducted by Moir, 4 lots of Leghorns were used. One lot each of pullets and 2-year-old hens were furnished with 5 cc. of cod liver oil per bird daily, whereas similar lots received linseed oil. The production of the birds in the different lots was very similar. Like results were also obtained in an experiment at the East of Scotland College of Agriculture by Newbigin in which the cod liver oil and linseed oil were compared in amounts of 1 cc. per bird daily with Ancona pullets.

At the West of Scotland College of Agriculture, Kinross conducted two experiments with somewhat similar results. The oil was fed in amounts of 5 cc. per bird daily in the first experiment and 2 cc. in the second experiment. The total egg production from October to May in the first experiment averaged 143.6, 123.5, and 121.8 eggs for the lot receiving no oil, cod liver oil, and linseed oil, respectively, while in the second experiment the averages when like supplements were fed from October to March were 97.5, 93.4, and 95.2 eggs.

The hatching percentages of some of the eggs obtained in the preceding experiments were determined, and no advantage was shown in the hatching or deaths in the shell for eggs laid by hens receiving the cod liver oil. The experiments all demonstrated the lack of necessity of supplying vitamin A to poultry receiving normal rations for growth, laying, and hatching.

Prevention of weak legs in experimental chickens, J. COLLIER (*Science*, 60 (1924), No. 1541, p. 42).—A very brief account of 21 chickens raised at the Harvard Medical School, Boston, on sterilized food without cod liver oil and in the absence of sunlight except that which was filtered through glass windows is given. The food consisted largely of buttermilk mash, with the addition of bone meal at 8 weeks of age and raw potatoes and carrots. Fine grains, crushed oyster shell, and grit were also supplied, as well as a few dozen hard-boiled eggs during the first three months. No leg weakness developed in the lot, and the author suggests that the use of the hard-boiled eggs, though fed in small amounts, may have been a contributory factor to normal development.

Notes on the management of farm poultry [trans. title] M. ELLISON, trans. by M. T. MARTÍNEZ (*Porto Rico Dept. Agr. and Labor Sta. Circ. 78* (1924), *Spanish ed.*, pp. 11).—A popular circular.

DAIRY FARMING—DAIRYING

[Report of] the Institute of Animal Nutrition, E. B. FORBES (*Pennsylvania Sta. Bul. 188* (1924), pp. 28, 29).—In addition to the investigations noted from other sources, brief results of experiments now in progress or just completed are given.

Feed has been found to be utilized by one animal 23.7 per cent more efficiently for milk production than for body increase, thus indicating a direct utilization of food in the production of milk rather than by transformation of body tissue. After allowing 0.6 lb. of digestible feed protein for maintenance, the additional protein requirement for milk production was about 1.25 times the protein content of the milk.

Calculations of the maintenance requirements of two purebred Jerseys and one grade Jersey have indicated 4.15, 5.42, and 5.57 therms of net energy, respectively, per 1,000 lbs. of live weight. An animal weighing 500 kg. has been found to require 30.5 calories per hour more while standing than when lying.

Experiments with dairy herd, J. M. SCOTT (*Florida Sta. Rpt. 1923, pp. 8, 26-28*).—In a test of the comparative value of corn and sorghum silage for milk production, two lots of four cows each receiving each type of silage in addition to a basal grain ration produced 5,448 lbs. of milk when the corn silage was fed and 5,003 lbs. of milk on the sorghum silage.

A similar comparison was made of Napier grass and Japanese cane silage, except that the silages were reversed for the two lots in each of three 30-day test periods. The total milk production was 4,752 lbs. on the Napier grass silage and 5,087 lbs. on the Japanese silage, the difference not being considered significant.

[Feeding experiments with dairy cattle in Guam], C. W. EDWARDS (*Guam Sta. Rpt. 1922, pp. 3, 4*).—The results of experiments conducted during two lactation periods to determine the value of adding concentrates to a ration of soiling crops and pasture are reported. The grain ration added during one of the lactation periods consisted of copra meal in combination with ground corn and rice bran. The grain was fed in amounts of approximately 1 lb. to 2 lbs. of milk produced. Both the total milk yields and the average daily yields were much higher in the periods when the grain was fed.

[Feeding experiments with dairy cattle at the Pennsylvania Station] (*Pennsylvania Sta. Bul. 188 (1924), pp. 17, 18*).—The results of several feeding experiments with dairy cattle are briefly reported.

Soy bean hay for milk production, S. I. Bechdel and P. S. Williams.—In a comparison of alfalfa and soy bean hay for milk production, when cows received the latter roughage they produced 3.9 per cent less milk than when receiving the former. In a second trial of 9 weeks' duration 3.3 per cent less milk was produced when receiving soy bean hay than when receiving alfalfa hay.

Clover v. alfalfa hay for milk production, S. I. Bechdel.—In this trial of 6 weeks' duration, cows receiving clover hay produced 6.5 per cent less milk than those receiving alfalfa hay.

The effect of feeding molasses to dairy cows, P. S. Williams.—Molasses has been found to slightly lessen the digestibility of the crude protein and dry matter in the ration, with practically no effect on the other nutrients.

Relative values of alfalfa, soy beans, and lespedeza hays, J. S. MOORE (*Mississippi Sta. Rpt. 1923, p. 28*).—No marked differences in the milk production of cows receiving the three different types of hay were observed, but when soy bean hay was fed considerable weight was lost.

An investigation of the partial replacement of hay by other feeds (trans. title), J. C. DE RUYTER DE WILDT and E. BROUWER (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 29 (1924), pp. 61-93, fig. 1*).—In experiments with 28 dairy cows divided into two lots, it was found that the substitution of about two-thirds of the hay in the ration by corn meal, pea and oat straw, and a milling by-product similar to fine wheat bran having a starch value approximately equal to the hay did not result in any significant change in the amount or the composition of the milk or in the body weight of the animals. The latter ration, according to prevailing prices in the Netherlands in 1922-23, was also considerably more economical. The entire experiment lasted over a period of about 4 months.

During the preliminary feeding period of about 1 month, the daily ration of each group of cows consisted of 165 kg. of hay, 24 kg. of dried beet pulp, 4 kg. of the milling by-product, 4 kg. of corn meal, 4 kg. of pea straw, 4 kg. of oat straw, 4 kg. of wheat straw, 315 kg. of fodder beets, 12 kg. of sesame cake, 12 kg. of coconut cake, and 16 kg. of linseed cake. In the test period of about 2

months' duration, 111 kg. of hay was replaced in the ration of 1 lot of cows by 28 kg. of the milling by-product, 12 kg. of corn meal, 28 kg. of pea straw, and 44 kg. of oat straw, while in the final period of about 1 month the rations of both lots were the same.

Feeding experiments with silage, R. RAE and H. W. GARDNER (*Jour. Min. Agr. [Gt. Brit.], 31 (1924), No. 3, pp. 261-266, pl. 1*).—The results of two experiments in comparing roots and silage for milk production are reported from the Hertfordshire Institute of Agriculture. Both experiments were conducted by the double reversal method with two lots of cows.

In the first experiment 40 lbs. of sainfoin silage replaced 40 of the 70 lbs. of roots and 1 lb. each of beans and oats fed in the other ration. In the second experiment one ration included 56 lbs. of roots and 23.5 lbs. of oat, tare, bean, and wheat silage, while the comparative ration included 50 lbs. of the same silage, with no roots. The results of both experiments were very similar, showing practically equal milk-producing powers for both rations in each experiment.

The relation of feeding and age of calving to the development of dairy heifers, O. E. REED, J. B. FITCH, and H. W. CAVE (*Kansas Sta. Bul. 233 (1924), pp. 3-38, figs. 8*).—This is a more detailed account of the investigation previously noted (*E. S. R., 49, p. 473*). The effect of the various rations fed on the development, and a comparison of the size and milk production, of the heifers calving at 24 and 30 months of age were considered. The lots receiving the alfalfa, silage, and grain rations made the greatest gains during the first and second years. Those receiving alfalfa hay alone developed the slowest, were smallest at calving, produced the smallest calves, and the milk production was lowest following both the first and second calving. The heifers receiving the alfalfa, silage, and grain ration excelled in most of these characteristics.

The heifers bred to calve at 24 months of age did not develop as well as animals on the same feed (alfalfa, silage, and grain) bred to calve at 30 months. They did, however, slightly excel in milk production, though they consumed more feed. Observations of the attainment of sexual maturity indicate that heat occurred at a younger age (12 to 14 months) in the better fed animals, while those on the alfalfa hay and silage or alfalfa alone did not come in heat until 18 or 19 months of age.

When experimental animals were placed in the regular herd after the completion of the second lactation, those raised on alfalfa hay alone or on alfalfa and corn silage showed marked increases in body weight, measurements, and milk and fat production, while the other animals did not show such marked increases. It is suggested that for the economical raising of Holstein heifers the ration consist of alfalfa and silage from weaning until within 3 or 4 months of freshening, when grain should be added.

Care and management of dairy bulls, J. R. DAWSON (*U. S. Dept. Agr., Farmers' Bul. 1412 (1924), pp. II+22, figs. 21*).—Practical directions are given for the care, management, and handling of dairy bulls.

Selection and management of the dairy bull, A. C. RAGSDALE (*Missouri Sta. Circ. 127 (1924), pp. 10, figs. 9*).—This is a popular discussion of the selection and management of dairy bulls, with special sections on the amount of service, ringing, dehorning, housing, feeding, and vicious bulls.

Purebred dairy sires: Their value and influence on production, T. M. OLSON and R. M. GILCREAST (*South Dakota Sta. Bul. 206 (1924), pp. 629-658, figs. 24*).—A popular bulletin dealing with the selection of purebred sires by pedigree and performance, pointing out particularly the essential differences in sires of pure breeding.

The influence of diet and sunlight upon the growth-promoting and antirachitic properties of the milk afforded by a cow, E. M. LUCE (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 716-739, pls. 2, figs. 2).—The growth-promoting and antirachitic properties of the milk produced by the cow fed on green and dry feeds in sunlight and in darkness, previously noted by Boas and Chick (*E. S. R.*, 52, p. 176), were determined with rats. In making the determinations of the growth-promoting properties, the milk was added in amounts varying from 3 to 20 cc. daily to the rations of rats which had ceased to grow for from 10 to 14 days, due to a vitamin A deficiency in the ration. The growth-promoting power of the milk was measured in vitamin units, one unit being the amount required to produce average weekly gains of from 10 to 12 gm. per rat during a 35-day test period.

In determining the antirachitic properties of the milk, the experimental rats were killed and post-mortems made, as well as histological examinations of the ribs with comparisons of control animals receiving no milk. The results indicate that the growth-promoting properties of the milk are directly affected by the diet, but that this effect is gradual rather than immediate. It required 3 months for the growth-promoting properties to drop from 41 to 13 units per 100 cc. of milk after changing the cow from outdoor pasture feeding to dry feed. Only a slight drop in the value was expressed by putting the cow in the dark, whereas a rise in the growth-promoting ability occurred when green feeds were substituted, though the cow was continually kept in the dark stall.

In the study of the antirachitic properties, the milk from the cow on pasture prevented rickets, given in amounts of from 2 to 3 cc. per rat daily. After 4½ months on a fat-soluble vitamin deficient ration, a decrease in the antirachitic value was recognized. The antirachitic property increased slightly on changing the ration to green grass, though the cow was still kept in the dark. Placing the cow on pasture restored the antirachitic properties to the milk, which were largely retained even after 2 months of dry feeding in the sunlight. The calf born to this animal during the dry feeding in the dark was normal, and after 3 months' suckling on the mother, during which time satisfactory gains had been made, the calf was killed and a post-mortem examination showed no evidence of rickets. The author concludes that the diet of the cow is the main factor in determining the growth-promoting value of the milk, while the antirachitic value seems to depend on the illumination as well as on the diet.

On the producing of milk having a low bacterial content, W. SADLER, C. D. KELLY, and G. R. MARTIN (*Jour. Hyg. [London]*, 22 (1924), No. 4, pp. 410-412).—This is an extended abstract of the article previously noted (*E. S. R.*, 50, p. 781).

Studies on pasteurization.—XI, XII, S. H. AYERS and W. T. JOHNSON, JR. (*Jour. Bact.*, 9 (1924), No. 3, pp. 279-284, 285-300).—These two studies continue earlier work¹ at the Dairy Division, U. S. D. A.

XI. The "majority" and "absolute" thermal death-points of bacteria in relation to pasteurization.—It has been found that a temperature of 135° F. for 30 minutes reduced the content of *Bacillus aerogenes* in skim and whole milk samples artificially inoculated from over 4,000,000 per cubic centimeter in each case to 237 and 53, respectively, per cubic centimeter, as determined by the plate count. Though no bacteria were detected by plating 1-cc. samples of similar milk heated to from 140 to 145°, respectively, for 30 minutes, the organisms grew in the main part of the milk, which was kept from further contamination and placed in the incubator. A temperature of 150° was found necessary to absolutely kill all the organisms. The wide range of temperature between that

¹ U. S. Dept. Agr. Bul. 342, rev. (1922), pp. 27.

required to kill the majority of the organisms and that necessary to destroy all of a certain type is thus pointed out.

XII. Cause and significance of pin-point colonies from pasteurized milk.—Experiences with the occurrence of organisms which increase in number during pasteurization are cited from several plants. These organisms produce pin-point colonies, probably more due to their crowded condition than to their natural characteristics. A thermophilic rod which was isolated from one plant is described morphologically and as to growth habits. The optimum temperature for growth was between 122 and 145°, growing most rapidly at pasteurization temperature. The organism is termed *Lactobacillus thermophilus*.

In a study of the thermal death point, it was found that 180°, or 160° for 30 minutes, were required to kill it. It increased slowly at a storage temperature of 68°, but decreased in milk when held for 24 hours at 39.2°. The source of this organism in milk supplies was not determined, though it is frequently present in raw milk in small quantities. It may be eliminated from the utensils by a thorough sterilization above 180°, and where such precautions are taken little difficulty is likely to be experienced with it. Pin-point colonies should be studied to determine whether they are due to thermophilic or to heat-resistant bacteria in endeavoring to eliminate them from a plant.

Elimination of germs from dairy utensils.—**III, Steaming cans over a jet,** M. J. PRUCHA and H. A. HARDING (*Illinois Sta. Bul.* 254 (1924), pp. 228-234).—This study, which is a continuation of investigations noted in Bulletin 230 (E. S. R., 44, p. 371), has been essentially reported (E. S. R., 47, p. 582).

On the agglutination of fat globules.—**I, Preliminary investigations of the influence of heated and unheated blood serum and of skim milk on the rising of cream** [trans. title], W. VAN DAM, E. HEKMA, and H. A. SIRKS (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 28 (1923), pp. 100-112 pls. 5).*—In these investigations both heated and unheated blood serums were added in amounts of 5 per cent to the milk of various cows. Some of the serum had been held as long as 25 days. The amount of cream rising on the milk, to which the serum had been added in from 1½ to 5¼ hours at temperatures of from 7 to 12° C. (44.6 to 53.6° F.), was compared with the amount of cream rising on milk to which an equivalent amount of water had been added.

In some milk of good creaming qualities the addition of the blood serum had practically no influence, but the creaming grade of milk in which the cream rose poorly was in some cases more than trebled. The heating of the blood serum to about 65° tended to destroy the properties which increased the rate at which the cream rose. The results, with the addition of skim milk from other cows in amounts of from 25 to 67 per cent, were not so conclusive, as some seemed to improve poor creaming milk while others did not.

On the agglutination of butterfat droplets and their electrical charge [trans. title], H. A. SIRKS (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 29 (1924), pp. 137-153).*—The similarity between the importance of the electrical charge of butterfat droplets in agglutination and the part played by the electrical charges on red blood corpuscles in agglutination was demonstrated experimentally. The effect of milk proteins and other characters of the milk on the rising of cream is also discussed.

[Dairy products experiments at the Pennsylvania Station] (*Pennsylvania Sta. Bul.* 188 (1924), pp. 18-20, fig. 1).—The progress made in ice cream, cheese, and market milk investigations is briefly noted.

Problems in the manufacture of ice cream, W. B. Combs, W. H. Martin, and I. R. Knapp.—The continuation of these experiments with the McMichael viscosimeter (E. S. R., 50, p. 477) indicated that pasteurization at 145° F. for 30 minutes or 165° for 5 minutes reduced the viscosity of the ice cream mix 25.3 and 9.8 per cent, respectively. Viscolizing 20 per cent cream under 2,500 lbs. pressure at a temperature of 110° increased the viscosity 1,114 per cent, but similar viscolization of the ice cream mix increased the viscosity only 11.4 per cent. In other experiments no relation was found between the acidity of the mix and the quality of the frozen ice cream. Casein was found to reach its maximum of water imbibition as the acidity increased, but too much acidity destroyed this property. Bacteria seemed to bear no relation to the quality of ice cream.

Cheese problems, N. A. Huggler.—In studying the effect of clarification of milk on the quality of the cheese made from it, clarified milk was found to produce a cheese having a higher score than unclarified milk except when the milk was of poor quality and was handled under ordinary conditions. The improvement in the score of cheese made from good quality milk or milk handled under strictly sanitary conditions varied from 1.59 to 2.83 points. Clarification also reduced the amount of gas appearing in the milk and the curd to a slight extent.

Cream line studies of market milk, W. H. Martin.—Studies of the effect of various milk plant operations on the cream line indicated that fresh raw milk held at 35° showed the largest amount of cream at the end of a 2-hour holding period. Clarification and pumping milk cold slightly reduced the cream layer, while pasteurizing for 30 minutes at from 144 to 145°, followed by rapid cooling, caused a noticeable reduction in the cream layer. Pumping hot pasteurized milk had no effect on the cream layer.

Reduction of high colour in butter, A. T. R. BROWN (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 4, pp. 281, 282).—In experiments carried on at one factory no difference was observed in the degree of color of salted or unsalted butter made from pasteurized or unpasteurized cream with or without the neutralization by bicarbonate of soda or lime. In experiments at another factory the color of the butter was lighter when the cream was neutralized to 0.2 per cent acidity instead of 0.25 per cent, churned at 47° instead of 51° C. (123.8° F.), and washed with water at 47° instead of 49°. The texture and body of the butter were also improved under the latter conditions.

Green colour in butter, A. M. BROWN (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 4, pp. 275-280).—The occurrence of a greenish color in butter is described. On study the fat seemed to be normal, but the color was associated with the curd and probably was of a melanin origin produced by the breaking down of the proteins. Analyses showed the presence of tyrosins and tryptophans. The presence of salt in the butter seemed to deepen the color. An especially heavy infestation of pastures by aphids, with the occurrence of sores on the cattle, is suspected as having some influence on the abnormal condition of the butter.

Cheese making, J. L. SAMMIS (*Madison, Wis.: Cheese Maker Book Co.*, 1924, 7 ed., rev. and enl., pp. 245, figs. 71).—This is another edition of the book previously noted (E. S. R., 42, p. 269). The same general arrangement has been maintained, but the chapters have been revised to include an account of the newer methods and practices.

A mold of cheese [trans. title], F. W. J. BOEKHOUT and J. VAN BEYNUM (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.*, No. 28 (1923), pp. 113-118, pl. 1).—The morphological and cultural characteristics of a mold isolated from blue colored

spots on the rind of Gouda cheese are described. The organism belonging to the genus *Oospora* and resembling the species *O. otophila* produces a blue color when iron salts are available, otherwise a dark reddish-brown color is produced.

VETERINARY MEDICINE

Encyclopaedia of veterinary medicine, surgery, and obstetrics, edited by G. H. WOOLDRIDGE (*London: Henry Frowde and Hodder & Stoughton, 1923, vols. 1, pp. XIV+546+[2]+XXIII, pl. 1, figs. 146; 2, pp. VIII+547-1106+XXX, pls. 4, figs. 215*).—This first volume of this encyclopedia, a work contributed to by no less than 34 authors, deals with medicine and the second with surgery and obstetrics. The first volume takes up the subject as follows: Introduction and semiology (pp. 1-12), contagious diseases (pp. 13-186), diseases due to protozoan parasites (pp. 186-246), so-called constitutional diseases (pp. 247-260), local diseases (pp. 261-501), snake bite (pp. 501-506), poisons and poisoning (pp. 507-519), food and the principles of feeding (pp. 520-533), water and watering (pp. 533-536), and grass disease in the horse, in a two-page addendum. A classified list of worms affecting the domesticated animals (pp. 536-543) and a table of doses (pp. 544-546) are also included. Subject indexes accompany both volumes.

National Veterinary Medical Association of Great Britain and Ireland, Limited, annual congress at Aberdeen, 1924 (*London: Natl. Vet. Med. Assoc. Gt. Brit. and Ireland, Ltd., 1924, pp. 224, pl. 1*).—This report of the proceedings includes papers on The Genetic Aspects of Sterility, by F. A. E. Crew (pp. 33-43); The Exportation of Horses and Horse Flesh to Continental Countries, by R. G. Linton (pp. 45-72); Notes on Veterinary Education, by O. C. Bradley (pp. 75-84); The Influence of Nutrition on the Incidence of Disease, by J. B. Orr (pp. 87-99); Anaerobic Infections in Animals, by S. H. Gaiger (pp. 100-143); and A Clinical Survey of Simple Distemper, by G. H. Livesey (pp. 144-161).

Eighth biennial report of the Louisiana State Live Stock Sanitary Board, 1922-1924, E. P. FLOWER (*La. State Livestock Sanit. Bd. Bien. Rpt., 8 (1923-24), pp. 65*).—This report presents data on cattle tick eradication, stomach worm (*Haemonchus contortus*) in cattle and sheep, bovine tuberculosis, etc.

[Annual reports of the Civil Veterinary Department, United Provinces, for the years ended March 31, 1922 and 1923], E. W. OLIVER and S. G. M. HICKEY (*United Provs. [India] Civ. Vet. Dept. Ann. Rpts., 1922, pp. [4]+21, pl. 1; 1923, pp. [5]+22, pl. 1*).—These reports (E. S. R., 47, p. 283) include accounts of the occurrence of and control work with infectious diseases of cattle and other livestock.

Plants poisonous to live stock, H. C. LONG (*Cambridge: Univ. Press, 1924, 2. ed., rev., pp. VII+120, pl. 1*).—This is a revised edition of the work previously noted (E. S. R., 37, p. 688).

Investigations of the chemotherapy of Bayer 205 [transl. title], E. FOURNEAU, MR. and MRS. J. TRÉFOUEL, and J. VALLÉE (*Ann. Inst. Pasteur, 38 (1924), No. 2, pp. 81-114*).—The authors claim to have discovered the formula of Bayer 205, which is the substituted urea of 4, 6, 8 sodium *m*-aminobenzoyl, *p*-methyl, *m*-aminobenzoyl, 1 aminonaphthalene trisulphonate. A list is given of 69 references to the literature.

Studies on the toxicity of carbon tetrachloride, E. W. SCHULTZ and A. MARX (*Amer. Jour. Trop. Med., 4 (1924), No. 5, pp. 469-482, pls. 2*).—Investigations were conducted at Stanford University, in which the toxic action of various doses of carbon tetrachloride on the liver was determined. It was

found that doses as small as 0.05 cc. per kilogram produced hepatic lesions in some animals, but that the lesions were usually of a mild grade, this dose being near the limits of safety. The simultaneous administration of magnesium sulfate decreased the toxic action of carbon tetrachloride on the liver. The protection offered by the simultaneous administration of magnesium sulfate is thought sufficient to place the usual therapeutic dose of 3 cc. for a human adult within the limits of safety. Magnesium sulfate apparently does not diminish the anthelmintic action of carbon tetrachloride. No definite changes were observed in the kidneys.

The leucocyte in health and disease, C. J. BOND (*London: H. K. Lewis & Co., 1924, pp. VIII+84, pls. 24*).—This monograph is essentially a record of the author's extensive investigations on the part played by the leucocytes in the defensive mechanism of the body. Microphotographs illustrating the text are assembled at the end of the volume.

Ascaris sensitization, B. H. RANSOM, W. T. HARRISON, and J. F. COUCH (*Jour. Agr. Research [U. S.], 28 (1924), No. 6, pp. 577-582, pl. 1*).—This is a brief progress report of investigations that are the outcome of the discovery by one of the authors of his susceptibility to the toxic action of *A. lumbricoides* on contact with the worm. Sensitive individuals exhibit a positive skin reaction when this substance is applied to a scratch on the skin, similar to that exhibited in cutaneous tests for so-called foreign-protein sensitization. In the course of the work about 20 persons, all white adults, were tested for sensitiveness by means of a cutaneous scratch test. Among the 20 there were 4 reactors, all of whom had been more or less exposed during periods of from 5 to 25 years to contact with *Ascaris*. The results of experiments conducted, while not absolutely conclusive, indicate that the meat of *Ascaris*-infested hogs does not contain the substance that causes a urticarial skin reaction in *Ascaris*-sensitive individuals.

"Cutaneous tests on sensitive human subjects, made with various fractions of an aqueous extract of *Ascaris* material separated by chemical and physical means, have shown that the substance in this extract that causes the skin reaction is absent from the globulin fraction. It is present in the albumin fraction, and is also present in the filtrate after precipitation of the albumin and globulin fractions by ammonium sulfate. It is weakened by oxidation with potassium permanganate. It is not volatile at temperatures between 20 and 100° C. It is thermolabile, and is destroyed by exposure to a temperature of about 100° for less than an hour, but may survive exposure to a temperature as high as 100° acting for a period of about 15 minutes. It is destroyed in the albumin fraction by digestion with pepsin. It is soluble in 50 per cent alcohol. From the filtrate obtained after precipitation of the globulin and albumin fractions with ammonium sulfate, it is wholly adsorbed in the presence of acid by Lloyd's reagent, and wholly precipitated by Mayer's solution. It is also wholly adsorbed from the acidified albumin fraction by Lloyd's reagent, but has not been recovered from the latter by subsequent treatment with weak alkali, a procedure which releases it from Lloyd's reagent after adsorption from the aqueous extract from which the albumin and globulin fractions have been removed by precipitation with ammonium sulfate.

"The question whether the substance in *A. lumbricoides* that causes the skin reaction in sensitive human subjects is of protein nature has not been answered by the investigations herein reported. A substance or substances that cause local reactions in some hogs and some sheep, comparable to the reactions observed in human subjects, are present in *A. lumbricoides*. The ophthalmic reactions observed in those animals are altogether similar to those heretofore

observed by Weinberg and Julien [E. S. R., 25, p. 590] following the installation of the body-cavity fluid of *A. equorum* into the eyes of horses."

The bush-sickness investigation, B. C. ASTON (*New Zeal. Jour. Agr.*, 28 (1924), Nos. 4, pp. 215-238, figs. 7; 5, pp. 301-305; 6, pp. 381-390, fig. 1; 29 (1924), Nos. 1, pp. 14-17; 2, pp. 84-91).—The first of these five numbers deals with five years' work at the Mamaku Demonstration Farm, and the other four report on laboratory work with what has been found to be a progressive anemia that affects ruminants only and leads to the death of the animals if they are not removed to healthy country. Chemical analyses of the soils, pasture plants, and animal specimens from the affected country show a deficiency of iron compared with what may be found in normal specimens from a healthy country.

Further studies on the potency of botulinus toxin, J. BRONFENBRENNER (*Abs. in Soc. Expt. and Med. Proc.*, 21 (1924), No. 6, p. 318).—It is noted that the potency of botulinus toxin is lowered by diluting it in solutions of sodium chloride and other salts of mono- and polyvalent metals and raised by diluting it in normal horse serum or ordinary broth.

"In view of the tendency of foreign serum to increase the toxic action of botulinus toxin, it is particularly important to determine carefully the type of toxin involved before administering antitoxin. Actual experiments have shown that at least the animals receiving heterologous antitoxin (type B) together with botulinus toxin (type A) die more promptly than the controls receiving the toxin alone."

Foot-and-mouth disease, with special reference to the outbreak of 1914, J. R. MOHLER (*U. S. Dept. Agr., Dept. Circ. 325* (1924), pp. 32, figs. 14).—This is a discussion particularly of the outbreak of foot-and-mouth disease discovered in the fall of 1914, which extended to 22 States and the District of Columbia.

Birds in relation to the foot-and-mouth disease of cattle, W. L. M[CATEE] (*Auk*, 41 (1924), No. 4, pp. 628, 629).—The author refers briefly to reports of the transmission of foot-and-mouth disease by birds (E. S. R., 50, pp. 380, 786). Further investigations are considered necessary before definite conclusions can be drawn.

The appearance of specific antibodies in the serum* of rabbits by intratracheal and intravenous injections of living tubercle bacilli, B. M. FRIED and E. E. PROCTOR (*Abs. in Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, pp. 396-398, fig. 1).—A comparative study is reported of the production of specific antibodies in rabbits by the intratracheal and intravenous injection of living human strains of tubercle bacilli.

Following a single intravenous injection, antibodies were detected by the complement fixation reaction at the end of the first week, while after a corresponding intratracheal injection they could not be detected until the end of the third week. The maximum value was reached at the end of the first month following intravenous, and at the end of the sixth week following intratracheal, injection.

It is concluded that the intravenous method is superior to the intratracheal on account of the earlier appearance and greater number of antibodies.

Vaccination of cattle against tuberculosis and a new method of prophylaxis of bovine tuberculosis [trans. title], A. CALMETTE and C. GUÉRIN (*Ann. Inst. Pasteur*, 38 (1924), No. 5, pp. 371-398, figs. 6; *abs in North Amer. Vet.*, 5 (1924), No. 8, pp. 333, 334).—The authors review the researches which they have conducted for several years on the use of bile-treated tubercle bacilli in the vaccination of laboratory animals against bovine tuberculosis (E. S. R.,

48, p. 483), report similar success in the vaccination of cattle on an experimental scale, and outline measures which are being taken on certain farms in France to render herds of cattle permanently free of tuberculosis by systematic yearly injections of the bile-treated bacilli.

In the experimental studies, which were arranged to test the degree and duration of the immunity secured by the use of the vaccine, six groups of two heifers each were vaccinated at the age of 6 or 8 months by subcutaneous injections in the region of the breast of from 50 to 100 mg. of the bile-treated bacilli, B. C. G. (bacilli of Calmette and Guérin), mixed with 10 cc. of physiological salt solution. At intervals of 1, 3, 6, 12, 12, and 18 months after the injection the animals in the respective groups were subjected to tuberculous infection by the intravenous injection of 5 mg. of virulent bovine tubercle bacilli. An unvaccinated control for each group received the same treatment. The controls without exception developed military or pulmonary tuberculosis, while the inoculated animals up to the final group, which did not receive the virulent organisms until 18 months after vaccination, did not develop the disease as shown by post-mortem examination.

In the practical application of the method, all of the heifers and calves of the herds on two farms are being vaccinated each year as described above. The experiment started in 1921, and thus far the vaccination has proved entirely harmless and no tuberculosis has appeared in the herds.

Udder diseases of dairy cows, H. BUNYEA (*U. S. Dept. Agr., Farmers' Bul. 1422* (1924), pp. 11-18, figs. 6).—This is a practical summary of information.

Contagious abortion of bovines [trans. title], A. RIVERA (*Porto Rico Dept. Agr. and Labor Sta., Circ. 77* (1924), *Spanish ed.*, pp. 12, figs. 3).—This is a brief summary of information, including means of treatment and prevention.

Contagious abortion in cattle, F. B. HADLEY (*Wisconsin Sta. Bul. 368* (1924), pp. 3-24, figs. 5).—This is a practical review of the present status of knowledge of this disease and means for its control.

[Stomach worms in lambs], E. BARNETT (*Mississippi Sta. Rpt. 1923*, pp. 15, 16).—Careful observations made to determine the age of the lamb or season of the year at which the stomach worm becomes most active show that lambs coming in January may be marketed at a weight of 50 lbs. or more with little or no infestation. It is pointed out that occasionally a mature ewe on slaughter is found to be free from infestation, while lambs, at least late in the summer, are found almost invariably to show infestation, yet are sometimes entirely free.

Verminous broncho-pneumonia in the pig due to *Metastrongylus apri*, with observations on the chloroform method of treatment, N. BISSET (*Vet. Jour.*, 80 (1924), No. 592, pp. 377-382, figs. 3).—The author concludes that the time of the year is of little importance in connection with outbreaks of infestation with *M. apri*. The first case was observed to occur in February and the second in July, with a recurrence in August. The author considers marshy ground to be the most likely source of infection. The parasites are situated in greatest numbers in the periphery of the lungs, the females greatly predominating numerically. The eggs do not appear to hatch in the respiratory tract. Adult parasites are destroyed by immersion in water, but will emerge from the lungs and live for three days if these organs are placed in physiological saline at 37° C. (98.6° F.). Chloroform administered intranasally in doses of 2 cc. per pig (1 cc. per nostril) by means of a double nozzled hypodermic syringe appears to be effective. Three treatments at 4-day intervals are preferable.

The influence of the bile on the swine erysipelas bacillus [trans. title], J. KOLDA (*Rev. Gén. Méd. Vét.*, 33 (1924), No. 390, pp. 293-312, figs. 3).—The

author finds the bile of the ox and of the hog to be good nutrient media for the cultivation of the swine erysipelas bacillus, the presence of bile in the media causing filamentous growth. In old and dry biliary cultures, granules (sporoids) are formed in the filaments which are more resistant than the vegetative forms. One-tenth* of 1 per cent sodium glycocholate exerts a bactericidal action in vitro on this bacillus, while the same strength of sodium taurocholate renders cultivation difficult, but 0.0001 per cent strengths of the two salts favor the cultivation of the organism. The sodium taurocholate is the component of bile that favors filamentous growth. The virulence of cultures of the bacillus when mixed with beef or hog bile is diminished in the first and increased in the second phase of contact, a temperature of 37° C. (98.6° F.) favoring the appearance of the second phase. Cultivation in series in pure bile does not diminish the virulence of stocks. The bile of mice which succumbed to swine erysipelas regularly contained the bacillus. The organism shows marked affinity for the subepithelial lymphatic spaces. The injection of a suitable amount of a culture of the organism into the gall bladder of the rabbit confers an active immunity upon the animal.

On the toxicity of seeds of *Cassia occidentalis* L. for the horse [trans. title], HENRY, BONNOTTE, and LEBLOIS (*Bul. Soc. Cent. Méd. Vét.*, 100 (1924), No. 10, pp. 249-256).—A discussion of the poisonous effect of the seeds of this legume, which is widely distributed in all of the intertropical regions, particularly in Brazil and India.

Avian variola (true diphtheria or contagious epithelioma), contagious coryza, and false diphtheria [trans. title], J. BASSER (*Rec. Méd. Vét.*, 100 (1924), No. 8, pp. 190-228, figs. 11).—In this report of an extensive study of the diseases in fowls classed under the various names listed in the title, experimental data are first given in proof of the theory that true avian diphtheria and contagious epithelioma of fowls are identical, the development of either one depending upon the site of infection with the same material. The two conditions are classed as variola, and an experimental study of their pathology is reported in considerable detail as follows:

Attempts to increase or decrease the virulence of the virus by animal passage gave negative results. Material from the lesions of the skin and of the mucous membrane retained its virulence in vitro for about six weeks. The virulence of the blood of infected fowls was found to be transitory, but it is considered probable that at the height of infection the blood is always virulent. Inoculation of pigeons, rabbits, and calves with the virus gave negative results.

Inoculation of the virus intradermally at the junction of the skin and mucous membrane, as in the corner of the beak, was followed in from 4 to 6 days by the appearance of lesions in the skin and mucous membrane and by inflammation and the appearance of pustules in the eye. Following such inoculation the fowls recovered and were consequently immune or died, depending upon the amount and virulence of the material injected. Similar results were obtained when the virus was injected intravenously. The results following subcutaneous or intracutaneous injection depended upon whether the skin was smooth or feathered. In the former case the lesions were localized and the fowls were readily immunized. In the latter the reaction was much more severe following the same amount of virus. Injection into the pectoral muscle caused local lesions only, unless the dose was very large, and immunity resulted. The extent of active immunity secured by such inoculations is thought to depend chiefly upon the quantity of virus which penetrates the organism. A period of from 18 to 20 days is required for the establishment of immunity, and its duration is at least five months and possibly longer. Attempts to secure

passive immunity by the use of serum from hyperimmunized fowls were without result.

The method of immunization recommended as safest and most reliable is injection into the pectoral muscle. The disadvantages of this method are summarized as the length of time ensuing before immunity is secured and the creation of virulent external lesions which may spread the virus. These are offset by the simplicity of the operation, the lack of danger, and the strength of the immunity secured. In a flock in which the disease has appeared, it is recommended that all fowls not showing clinical symptoms be vaccinated and moved to other quarters. In 8 days the vaccinated fowls should be reexamined and those which were in the state of incubation at the time of vaccination and have since come down with the disease be separated. The vaccinated fowls should not be returned to the flock for 20 days.

Voluminous and persistent lesions during the course of avian variola are considered to be the consequence of secondary microbial infection. In such exudates the author has identified *Pasteurella*, the bacillus of necrosis, the pseudodiphtheric bacillus, *Bacillus coli*, *B. pyocyaneus*, staphylococci, and streptococci. Evidence is presented that these are for the most part non-pathogenic for fowls.

In conclusion, brief descriptions are given of contagious coryza and false diphtheria.

Bacillary white diarrhoea of chicks, I. E. NEWSOM (*Colorado Sta. [Bul.] 293 (1924), pp. 8, figs. 4*).—This is a brief practical summary of information.

Out of 1,394 samples of blood received in 20 shipments and tested during the year, 314, or 23 per cent, reacted to the agglutination test. In only two instances were entirely negative results obtained, and in one of these only 9 samples were furnished and in the other only 6. As pointed out by the author, this indicates that the disease is quite widespread in Colorado. With the growth of large hatcheries and the selling of day-old chicks, white diarrhea has become a very serious malady within the State. In many instances during the year from 90 to 95 per cent of all day-old chicks received by poultrymen and farmers died within a week after their arrival. Attention is called to the pioneer work in Illinois in accrediting flocks.

Auricular scabies (parasitic otitis) in silver black foxes, J. A. ALLEN (*Canad. Vet. Rec., 5 (1924), No. 1, pp. 12-16, figs. 2*).—The parasite *Otodectes cynotis* was first found in domesticated foxes in 1919, since which time numerous examinations have been made that show this mite particularly rampant in the ranch fox. In some cases ear mites have been found to be present in nearly 100 per cent of the animals on certain ranches, and the affection seems to go in cycles, appearing with more frequency in some years than others. The author gives the symptoms of the affection as observed in dogs and foxes and describes a typical case. Directions for treatment are included.

Filariasis, with especial reference to Australia and its dependencies, R. W. CILENTO (*Aust. Dept. Health, Serv. Pub. (Trop. Div.) No. 4 [1923], pp. VII+3-78, figs. 14*).—This is a review of the status of knowledge of the disease, with special reference to Australia and its dependencies.

RURAL ENGINEERING

Experimental study of air lift pumps and application of results to design, C. N. WARD and L. H. KESSLER (*Wis. Univ. Bul., Engin. Ser., 9 (1924), No. 4, pp. 166, pls. 3, figs. 59*).—Laboratory studies begun in 1919 on air-lift pumps are reported.

The results showed that the efficiency of an air-lift pump depends primarily upon the conditions of flow in the eduction pipe. Great refinement in the design of foot pieces, small air openings for dividing the air into fine bubbles, and special devices for mixing the air with the water were found to be unnecessary. There should be no central nozzle or projecting part to obstruct the flow of water in the foot piece. It was found that the smaller the pump in a given well the narrower will be the range of rate of pumping in which high efficiencies may be obtained.

The submergence required for maximum possible efficiency ranged from 65 to 75 per cent in most cases, the lower range being approached in wells with a high delivery head. Very small pumps gave relatively high efficiencies with low submergences, a 1-in. pump showing good efficiency at a submergence as low as 45 per cent. It is considered possible for this reason that the air-lift pump may be satisfactorily adapted to the pumping of small wells such as are used for rural water supplies.

The combined friction and slip losses due to the flow in eduction pipes were found to follow a different law than that governing the flow of water or air in a pipe. There was a comparatively simple relation between frictional losses and velocity of flow in an eduction pipe for any particular mixture of air and water. At a given velocity of flow in a given eduction pipe the losses increased as the ratio of volume of air to volume of water increased.

There was found to be a particular velocity of flow for any ratio of volume of air to volume of water which is accompanied by a minimum loss of head. The losses increased very rapidly when the average velocity was reduced below the above velocity. The rate of increase of losses with increase of velocity was found to depend upon the diameter of the eduction pipe. It was possible to use relatively high velocities in large eduction pipes, but in small pipes the losses increased rapidly with an increase of velocity above that giving maximum efficiency.

It was found necessary to make smooth joints in eduction pipes and to change from one size of pipe to another very gradually. Sudden enlargements were detrimental to efficient operation, and a horizontal travel of a mixture of air and water resulted in a separation of the air from the water. This is taken to indicate that eduction pipes should always be vertical.

Methods of design and testing are discussed.

Surface water supply of lower Columbia River and Pacific slope drainage basins in Oregon 1919-1920 (*U. S. Geol. Survey, Water-Supply Paper 514* (1924), pp. V+204, pls. 2).—This report, prepared in cooperation with the States of Oregon and Washington, presents the results of measurements of flow made on streams in the drainage basins of the lower Columbia River and Pacific slope in Oregon for the years ended September 30, 1919 and 1920.

Surface water supply of the North Atlantic slope drainage basins, 1921 (*U. S. Geol. Survey, Water-Supply Paper 521* (1924), pp. VI+294, pls. 2).—This report, prepared in cooperation with the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, New York, New Jersey, and Pennsylvania, presents the results of measurements of flow made on streams in the drainage basins of the North Atlantic slope during the year ended September 30, 1921.

Water powers of the Great Salt Lake basin, R. R. WOOLLEY (*U. S. Geol. Survey, Water-Supply Paper 517* (1924), pp. XVI+270, pls. 13, figs. 8).—Following an introduction by N. C. Grover, data are presented on the geography, geology, physiography, climate, and general features of the Great Salt Lake basin, together with the results of studies on stream flow, reservoirs and reservoir sites, and developed and undeveloped water power of the region.

Special attention is given to the features of power plants in the drainage basins of the Jordan River and Utah Lake.

Measurement of irrigation water, H. E. MURDOCK and J. R. BARKER (*Montana Sta. Circ.* 126 (1924), pp. 39, figs. 26).—Practical information on the measurement of irrigation water and on suitable devices for use in this work is presented.

Supplemental irrigation for the Willamette Valley, W. L. POWERS (*Oregon Sta. Circ.* 57 (1924), pp. 8, figs. 2).—Practical information on supplemental irrigation in the Willamette Valley is briefly presented, together with a summary of the results of 14 years' practice.

Studies of field spraying in 1922 [trans. title], KRÜGER (*Technik Landw.*, 4 (1923), No. 4, pp. 66-69).—Experiments with spray irrigation on rye, oats, serradella, lupines, clover, potatoes, and vetch are briefly reported. The results demonstrated the utility of spray irrigation with pure water in increasing crop yields and in preventing drought injury.

Drain wet fields, E. R. JONES and O. R. ZEASMAN (*Wisconsin Sta. Bul.* 365 (1924), pp. 24, figs. 20).—Practical information on tile drainage on the individual Wisconsin farm is presented.

Standard specifications for steel highway bridges (*U. S. Dept. Agr. Bul.* 1259 (1924), pp. [2]+48, figs. 7).—The text is presented of standard specifications for steel highway bridges which were recommended by the subcommittee on bridges and structures of the American Association of State Highway Officials and approved by the Secretary of Agriculture for use in connection with the administration of Federal appropriations for construction of the Federal-aid highway system.

Comparative tests of new billet steel and rerolled steel reinforcing bars, J. B. KOMMERS (*Wis. Univ. Bul., Engin. Ser.*, 9 (1924), No. 3, pp. 32, figs. 6).—Studies are reported in which deformed bars of new billet, intermediate grade steel showed satisfactory ductility. A large percentage of the bars tested fell below the strength requirements, especially for ultimate strength, 50 per cent falling 11.4 per cent below. This lack of strength seemed to be due to a low carbon content. Deformed bars of new billet, hard grade steel showed a small percentage which failed to meet the ductility requirements. A large percentage failed to meet the strength requirements, 65 per cent falling 4.2 per cent below the ultimate strength requirement. This lack of strength seemed to be due also to a low carbon content. Deformed bars of rerolled steel all showed satisfactory strength, but 42.5 per cent failed to meet the ductility requirements.

Cold bending of new billet bars of both intermediate and hard grades did not decrease their tensile strength. None of them failed in bending to the U or V shape. Cold bending of rerolled bars seriously decreased their tensile strength, and 47 per cent failed in bending to the U shape. The standard cold bend test and also the U-bend and V-bend tests showed that the rerolled bars are likely to be very unreliable as regards uniformity. Projections on the rerolled bars made it more difficult for them to withstand cold bending, but when the bars had proper ductility the presence of projections was of little importance. The poor ductility of the rerolled bars seemed to be due either to a high carbon content or a medium carbon content in combination with a high phosphorus content.

These results are taken to indicate that new billet bars, while not meeting rigidly all the ordinary requirements for such steel, may be considered as reasonably satisfactory, but that rerolled bars, while of satisfactory strength,

must be considered as very unreliable for work under conditions subjecting them to cold bending.

Transmission of heat through building materials, F. B. ROWLEY (*Minn. Univ., Engin. Expt. Sta. Bul. 3* (1923), pp. VI+74, figs. 45).—The results of a series of tests on insulating materials and building construction are reported. The object of this work was (1) to develop an improved method for testing insulating and building materials which would eliminate some of the uncertain heat losses in methods commonly in use, (2) to determine the insulating value of certain classes of insulating material now on the market, and (3) to determine the insulating value of these materials as applied to practical building construction.

Insulating materials are tentatively classified as those used for insulation only, those used for insulation in combination with a plaster base, and those which may be used as either an insulating material or as a plaster base. In general, it was found that the lighter and more loosely matted the material the better is its insulating value. There was a variation in thickness and density of such materials, with a corresponding variation in insulating value. Materials of the same manufacture may vary in their thermal properties, and in some cases where one material shows a transmission constant slightly above or below a second material the samples might be so selected that the results would be reversed. Differences as high as 20 per cent were noted. Materials which were loosely matted and stitched between two layers of paper showed the greatest variation in thickness and in insulating value. A comparison of the tests made with and without plaster on the face of insulating materials showed that the insulating value of the plaster is very low, decreasing the transmission constant from 2 to 4 per cent.

Details of tests of wall sections are presented, and the method of calculating heat losses is outlined. The results show conclusively the value of insulating material as applied to wall construction.

The gas engine on the farm: Principles of operation and valve timing, F. G. BEHREND and F. L. FAIRBANKS (*N. Y. Agr. Col. (Cornell) Ext. Bul. 85* (1924), pp. 52, figs. 47).—The first part of this bulletin discusses the principles of operation of the farm gas engine, and the second part gives specific instructions for the timing of valves.

Nebraska tractor tests, 1921, 1922, and 1923, E. E. BRACKETT ET AL. (*Nebraska Sta. Bul. 200* (1924), pp. 16).—Supplementing Bulletin 177 (E. S. R., 45, p. 185), the results of tests of 32 tractors made under the provisions of the Nebraska testing law during the years 1921, 1922, and 1923 are presented and briefly discussed. Two tests conducted in 1924 are also noted.

Farm motor truck operation in the New England and Central Atlantic States, L. M. CHURCH (*U. S. Dept. Agr. Bul. 1254* (1924), pp. 28, figs. 12).—The results of a questionnaire, sent to several thousand farmers in the New England and Central Atlantic States known to be owners and users of motor trucks, for detailed information covering the use of these machines in farming operations are presented and discussed.

Standardization of wheel track widths and of the gather of axle skeins and dishing of wheels for farm hauling [trans. title], KONSCHAK (*Technik Landw.*, 4 (1923), No. 7, pp. 109-112, figs. 5).—An analytical discussion of the factors entering into the design of farm wagon wheels, skeins, and track widths, with particular reference to the gather of skeins and the dishing of wheels for different loads and wheel diameters, is presented. It is considered desirable for front and rear wheels to have the same track width to bring tractive resistance to a minimum, and a standard track width of 1,520 mm. (59.84 in.)

from center to center of felloes is also considered desirable for hauling conditions on level German farms.

The relation of skein gather and wheel dish is expressed by the formula $\epsilon = \phi + \gamma$, in which ϵ is the angle between the spoke and a line at right angles to the center line of the skein, ϕ is the angle between the center line of the skein and the center line of the main axle, and γ is the angle between a spoke exactly at the bottom side of the wheel and a line perpendicular to the center line of the main axle.

Present practices call for a skein gather for ordinary loads varying from less than 1 to about 3°, or from 1.6 to 5.25 per cent of the skein length. Heavier loads call for a gather of from 7 to 13 per cent. Too great a gather results in excessive friction on the thrust bearing, while too small a gather does not make proper use of the thrust bearing on rough roads. Experience has shown that the best construction consists of a slightly conical thimble with a medium gather. Similar rules prevail for wheel dishing.

Formulas are developed for the design of wheels having the proper dish and of axles and skeins with the proper gather for specific loads, track widths, and wheel diameters.

Belt speeds for the electrical driving of threshing machines [trans. title], L. RIEFSTAHL (*Technik Landw.*, 4 (1923), No. 10-11, pp. 160-162, figs. 2).—Data from various sources on belt and pulley speeds for threshing machines operated by steam engine, gas tractor, and electric motor are reported and discussed.

The necessity for the standardization of belt speeds for threshers of different capacities is emphasized as a basis for the proper design of electric motors for this work. It is concluded that the belt speed should never be less than 16 meters (52.5 ft.) per second for ordinary machines, and for the larger machines requiring 30 and more than 40 h. p. speeds of 18 and 20 meters per second, respectively, are desirable. In order to make a motor capable of operating threshers available for other belt uses on the farm, the necessity of standardizing motor belt pulleys for different jobs is considered evident.

Tests of a potato digging machine and estimation of the speed relations of the digging mechanism [trans. title], T. RUDZKI (*Rocz. Nauk Rolnicz.*, 10 (1923), No. 1, pp. 52-82, figs. 13).—The results of an analytical and graphical study and actual field tests of a potato digging machine employing digging forks operating at right angles to the forward direction of the machine are reported.

Parallel operation of the forks gave the best results, since the speed of any fork was never greater than the point at which it is fastened on the throwing axle.

The maximum throwing speed was found to be about 4 meters (13.12 feet.) per second. The forks removed a parallelogram of soil, the sides of which formed an angle with the direction of movement of from 14 to 16°. Thus the reaction of the fork movement could be determined with reference to its influence in increasing the draft of the machine. The average angle of removal of the soil and potatoes was approximately the same as the angle of inclination of the sides of the parallelogram of soil removed. A heavy inclination of the fork axle toward the horizontal was found to be favorable to operation.

Sharpening crosscut saws (*U. S. Dept. Agr., Forest Serv.*, [1924], pp. 22, figs. 16).—Practical information on the sharpening and setting of crosscut saws is presented.

Poultry house construction, A. R. LEE (*U. S. Dept. Agr., Farmers' Bul.* 1413 (1924), pp. II+28, figs. 18).—In a revision of Farmers' Bulletin 574

(E. S. R., 31, p. 93), detailed information is presented on methods of construction of various types of poultry houses, together with working drawings.

Studies on the chemical changes occurring in a sprinkling filter, F. L. CAMPBELL and W. RUDOLFS (*Amer. Jour. Pub. Health*, 14 (1924), No. 5, pp. 398-401, figs. 2).—Studies conducted at the New Jersey Experiment Stations in cooperation with the New Jersey State Department of Health on the annual cycle of biochemical changes occurring in a sprinkling filter are briefly reported. Sprinkling filters 6 ft. deep, made up of crushed stone resting on half-tile drains, were used in the studies. Samples were taken at frequent intervals at 1-, 3-, and 5-ft. depths. The results indicated that throughout the whole year most of the nitrification takes place at the bottom of the filter bed.

Experiments on the effects of certain chemicals on the protozoa on the film of the filter showed that the bulk of the down-flowing sewage does not filter through the film around the stones. Solutions of many times the concentration necessary to kill protozoa exposed directly to them had no effect on protozoa in the film. The film was not penetrated or partially penetrated by the toxic ions in the time of the experiment, which was about that of a normal spray on the beds. The fact that turbidity of the liquid always decreased most between the third level and the effluent is considered to be an additional argument for filtration through solids at the bottom of the bed.

Further results indicated that the value of greater depth in the bed would be to provide additional surface on which solids may be deposited and slowly digested by the organisms in the film, while nitrate formation takes place chiefly at the bottom. This is taken to indicate the importance of making the depth of bed dependent upon the concentration of the solids which the bed must handle. Weekly flooding of the beds during the summer months was found to reduce the nitrate content of the effluent to some extent. When flooding was stopped in September the nitrate content rose again for a short time until colder weather, and new solids brought it down to its lowest level at the beginning of the spring.

The observations as a whole seem to indicate that denitrification takes place to a greater or lesser extent continuously and simultaneously with nitrification. It becomes apparent, however, only when it exceeds nitrification. Practically all nitrites and nitrates in the effluent are formed in the bed, while the ammonia in the effluent is the sum of the ammonia originally thrown on the bed and of that produced in the bed. Most of the ammonia removal seems to take place at the level of highest nitrification. It is quite noticeable during the winter, but during the remainder of the year it seems to be obscured by an increasing amount of ammonia formed in the bed.

RURAL ECONOMICS AND SOCIOLOGY

Farm organization and management in Clinton County, Indiana, H. W. HAWTHORNE and H. M. DIXON (*U. S. Dept. Agr. Bul.* 1258 (1924), pp. 68, figs. 17).—Data are presented from a business analysis of 100 farms in Forest and Johnson Townships, Clinton Co., Ind., over a period of eight years. The first year's study was made in 1910, and the work was again taken up for the year 1913 and continued through seven successive years to 1919, inclusive.

The farms under study average 127 acres in size, 45 of them being smaller than 100 acres, while only 15 were larger than 180 acres. About a third of the land was devoted to corn, a little less than a third to small grains, and a little less than a fourth to clover and timothy.

The average farm capital for the first 4-year period was \$24,038 per farm and for the second 4-year period \$29,543. Of the total farm capital, about 90

per cent was in real estate and 10 per cent in working capital other than real estate. Real estate including buildings averaged \$174 per acre in the first period and \$203 in the second. Excluding buildings the values were \$160 and \$184 for the respective periods. There was an increase in the value of real estate per farm from 1910 to 1919 of 69 per cent.

The annual farm income averaged \$1,970 per farm for the 8-year period. It was highest in 1918 and lowest in 1910. The 8-year average labor income was \$631 per farm, ranging from \$44 in 1914 to \$1,421 in 1918. The average return on the farm capital was 5.7 per cent, ranging from as low as 3.9 per cent in 1914 to 7.9 per cent in 1918. The 8-year average of family living direct from the farm, which was not included in the above items, was estimated at \$347, having increased from \$262 in 1914 to \$495 in 1918.

About 40 per cent of these farms were operated by tenants. They, as a rule, operated larger farms than owners. Tenants renting for a half share of the crops operated smaller farms than tenants who rented for a half share of the crops and livestock. Tenants on smaller farms received a larger share of the farm incomes than did the landlords, but the reverse was true of tenants on the larger farms.

The farms heavily stocked with hogs were usually more successful than those on which other classes of stock predominated. It is suggested that the production of dairy products, poultry, and eggs on all farms and of beef cattle on the larger farms should be encouraged along with production of hogs, the principal money crop of the locality. The variations in relative prices of corn and hogs during different years were important factors in the incomes of given farms. In 1910 when hogs were relatively highest in price, they were the largest item of the receipts on 75 per cent of the more successful farms, and corn was the largest item on 8 per cent of this class of farms. In 1916 when hogs were relatively lowest, they were the most important source of receipts on 47 per cent of the more successful farms and corn was the predominating item on 45 per cent of this class of farms.

An economic study of farming in southwestern North Dakota, R. E. WILLARD and L. A. REYNOLDSON (*North Dakota Sta. Bul.* 180 (1924), pp. 4-47, figs. 5).—The study here reported was begun in the summer of 1922 by the station cooperating with the Bureau of Agricultural Economics, U. S. D. A., and reached 159 owner operators, who provided complete records covering their farm business for the year ended March 1, 1923.

The average size of farm operated was 817 acres, the range being from 160 to 3,600 acres. The farms of most frequent occurrence were from 320 to 960 acres in extent. Approximately 34 per cent of the farm area was devoted to crops, and in general more than half the crop land was devoted to wheat. Of the 159 farmers, 28 per cent owned all the land they operated. Land represented 81 per cent of the investment, its average value amounting to approximately \$20 per acre. Livestock, including work horses, amounted to 8.6 per cent of the investment and machinery slightly over 5 per cent. The average farm income was \$1,692, ranging from \$1,112 on small farms to \$2,300 on large ones.

When the percentage of gross income from stock increased from 3 to 60 per cent the investment in machinery decreased from 10.6 to 5.7 per cent. The percentage of pasture land in the total size of the farm increased as the amount of the livestock business increased. A slight tendency was indicated to realize better yields of wheat on farms handling more stock, while corn yielded materially better under the circumstances.

The average annual gain in net worth from the time of settlement to the present, not including increases in the value of land, was \$732. Including

increases in the value of land, the average annual gain in net worth amounted to \$1,120 per farm. Of the 159 farmers interviewed, 105 reported homesteading. Of 428 parcels of land reported, 231 were acquired by private purchase. The best size of farm for the region is said to be about 800 acres, with approximately one-third of the acreage devoted to crops. It is recommended that one-half of the crop area be devoted to wheat, about one-sixth to oats and barley, and from 7 to 10 per cent to corn. Flax may be substituted for wheat to a limited extent, and alfalfa, sweet clover, and millet are important minor crops. For farms of the most usual size, about 10 milch cows and double this number of other cattle are held to be advisable, and the better organized farms of about 275 acres in crops require 9 work horses.

An economic study of dairying on 163 farms in Herkimer County, New York, E. G. MISNER (*New York Cornell Sta. Bul. 432 (1924), pp. 3-59, figs. 5*).—The results of a cost study concerning production problems of certain New York dairy farms reported here were obtained in the summer of 1919 and apply to the year ended April 30, 1919. The cost factors analyzed are feed, bedding, labor, the hauling of milk, the use of buildings and equipment, interest, and miscellaneous charges. The returns from dairy cattle are grouped under the heads of milk and milk products, appreciation on cattle, manure recovered, and miscellaneous returns.

The average butterfat test was 3.53 per cent for the year but varied from 3.31 per cent in April to 4.03 per cent in November. A difference of 4 cts. per 100 lbs. of milk for each 0.1 per cent of butterfat was allowed by purchasers of milk in each of the months of the year under study. The milk sold wholesale during the year excluding that not paid for amounted to 19,876,482 lbs. valued at \$593,446. A loss was incurred of \$182,708. The herd cost of production was \$3.85 per 100 lbs. of milk, or \$1.09 per pound of butterfat, and the cow cost \$3.60 and \$1.02, respectively. Feed, excluding the charge for pasture, and human labor represented 79 per cent of the net cow cost of producing all milk. The net cost of hauling and delivering the milk to the milk station amounted to \$66,768. The average price received for all milk sold wholesale for which the producers were paid was \$2.94 per 100 lbs. of milk, or 83 cts. per pound of butterfat. The large loss on heifers, due in part to the fact that the milk charge to them was more than one-fourth of the appreciation, resulted in a herd cost per 100 lbs. of milk 25 cts. higher than the cow cost.

The total value of milk products sold was \$3,132. The average amount of milk used per operator's family was 2,613 lbs. Milk so consumed was credited to cows at 20 cts. less per 100 lbs. than the average price received for all milk for the year to allow for hauling charges. An average of 74.6 lbs. of butter was used per family on 46 farms making and using butter for family consumption.

The average investment for milk production, not including the value of crop land or any land other than pasture, the value of farming implements, that of livestock excepting cattle, or of silos and barns other than parts of the barns used for cattle, was \$10,284 per farm, \$405.29 per cow, \$7.83 per 100 lbs. of milk, and \$2.22 for each pound of butterfat produced. Slightly over one-third of the capital was invested in cows, one-third in pasture land, and less than one-third in herd bulls, other cattle, equipment, and feed and supplies.

Other phases of the problem for which data are presented include the breeds and weights of the animals; the seasons of milk production, together with the seasonal distribution of cost for concentrates, succulent feed, and dry forage; and the cost of raising heifers.

The cost of producing milk and dairy farm organization in Spokane and Stevens Counties, G. SEVERANCE and G. O. BAKER (*Washington Col. Sta.*

Bul. 182 (1924), pp. 5-36, figs. 3).—This study was made to supplement the investigation made in four dairy counties in western Washington and previously noted (*E. S. R.*, 48, p. 591). It follows the earlier one closely in general plan and bears out the conclusions arrived at there. The leading purpose was to develop a formula for determining the cost of producing milk, showing the amounts of measurable factors required in producing 100 lbs. of milk, so that the cost at any given time might be determined approximately by inserting current values in the formula. The basic cost formulas developed in this survey are compared with those to be found in the earlier Washington bulletin, as well as with the Pearson and Warren formulas. The importance is illustrated here of developing a separate formula for each distinctly different set of conditions.

Relation of land tenure to plantation organization, C. O. BRANNEN (*U. S. Dept. Agr. Bul. 1269 (1924), pp. 78, figs. 18).*—Plantation districts from Virginia to Texas were visited, representative planters and business men throughout the South were interviewed, and first-hand information and statistical data were collected for this study in order to determine the nature of plantation problems, giving particular attention to tenure and its relation to the labor problem. Furthermore, the information obtained furnishes the basis of presentation of the nature and characteristics of the plantation of the present day, with particular reference to the classes of labor employed, the cropping system, labor movements, the stability of the labor supply, plantation credit, and marketing. The present day plantation is defined as "a unified agricultural organization of considerable size under one management, of practically a continuous tract of land, operated as a single unit with respect to the methods of control of labor and products, all of which may be worked by wage hands, or all or a part of which may be subdivided and let to tenants." The three dominant elements expressed here are size, unity of operation, and control.

The general management of plantations was handled by owners on 79 per cent of plantations in 1910. Of the 206 plantations selected in 1920 for special study, it was found that of the 165 owner-operators 59 per cent lived on the farm, about 41 per cent in nearby towns, and one elsewhere; for the 41 manager-operated farms practically the same percentages hold. The average annual salary of 167 farm managers in 1920, including free house rent, board or family living, and pasture privileges for livestock, was \$2,100. The salaries of assistant managers and overseers, including perquisites, were \$1,550 and \$1,000, respectively.

Plantation labor, for the purpose of this study, is considered under the three heads of wage hands, croppers, and tenants. Of the improved land operated by croppers and tenants in 93 selected plantation counties in 1920, 33.3 per cent of the improved land was worked by croppers and 66.7 per cent by tenants. It would seem that slightly less than half of plantation labor throughout the region is tenant labor, with the remainder about equally divided between croppers and wage hands. While the proportion of negro to white labor has been slightly diminished, at present practically all common laborers on typical plantations are negroes and other nonwhites. The classes of wage labor and the wages paid are set forth. The cropper system is described, and the characteristics and importance of tenancy in the plantation system are considered. Of 79 cotton planters, 57 per cent expressed a preference for the cropper system, 35 per cent for share renting, and 8 per cent for cash renting.

Renting arrangements, labor supervision, labor movements and occupancy, and the selection of farm enterprises and diversification are described. Livestock is found in most of the plantation areas. It may be noted that 68 of

the plantations studied had an average of almost 300 head of cattle, and 54 had an average of 90 head of hogs. Livestock enterprises are nearly always handled by the landlord with wage labor, although in certain sections experiments are being tried out in landlord-tenant cooperation in dairy farming.

The problem of credit is considered from the points of view of both landlord and cropper. At the present time plantation operators rely for their credit almost entirely on the local banking institution. The landlord is the source of credit for the plantation croppers and tenants, and advances of such credit are made either directly by the landlord or on his indorsement. Of 237 plantations reporting, 29 per cent operated a commissary, 32 per cent used the plantation general store, and 39 per cent relied on local merchants. In 1920 and 1921 the average amount of credit advanced to 724 croppers on plantations was \$289 and to 506 plantation tenants \$555. Goods were sold at the plantation store or commissary at current cash prices, generally from 20 to 35 per cent above cost, according to the kinds of supplies and the estimated degree of risk, and in some cases 10 per cent of the amount was added to the account as interest at the end of the year. When the cost of administration is compared with the profit per acre derived from advances, it is found that the supply business on these plantations fails by \$1.06 per acre, or by 58 cts. per acre for cropper and tenant land, to sustain the outlay for administration. The credit advanced to croppers and tenants often represents borrowed capital, for which the landlord pays an average of 8 per cent interest, and he often is required to pay interest on at least a part of his loan for a longer time than he can collect interest on his advanced money. On the whole, it is not considered that the 18.6 per cent gross profit realized from the supply business on plantations is unreasonable.

The common practices in marketing cotton, tobacco, rice, and sugar cane are briefly set forth. Appendixes present tabulations of data.

Assessment and equalization of farm and city real estate in Kansas, E. ENGLUND (*Kansas Sta. Bul.* 232 (1924), pp. 3-70, figs. 5).—The basic data presented here were obtained from the records of bona fide sales of real estate in Kansas in a period of 10 years, 1913 to 1922, inclusive. The data included in the section presenting the inequalities between large and small properties are based on the sales of 10,307 items of farm real estate in 15 counties and 10,231 items of city real estate in 16 counties in all sections of the State. The other sections are based on data from selected counties, townships, and cities and on land transfers in all counties of the State.

It is concluded that small real estate properties are assessed at a higher percentage of true value than large ones, and that as a consequence of this discrepancy owners of small parcels are required to bear a portion of the taxes which the law intends that owners of large properties should pay. A number of probable reasons for this overassessment of small properties are given, as well as some of the probable consequences. The latter are held to be that an excess tax amounting to probably more than a million dollars annually is assessed on small properties, that this constitutes a hindrance to farm ownership and perhaps to home ownership in cities, and that it is probably a hindrance to wise city planning.

There was found to be a marked increase in the degree of inequality between large and small properties during the period under study. There was little or no change, however, in the degree of inequality among individual properties. A greater inequality was found among townships than among other assessing units or among individual properties. The inequality in the assessment of farm real estate is said to have decreased during the last 10 years among the counties, but the rate of assessment of city real estate has

become slightly more unequal. Inequality in the rate of assessment among individual parcels of farm real estate is nearly 14 times as important as among counties from the standpoint of the amount of taxes levied on over-assessed properties in excess of legal requirements. The principal reason for important inequalities is said to be inherent in the present system of valuation, the greater inequalities and the most pronounced tendency toward retrogression in equalization being found at the local assessors' point of contact with property.

A plan is suggested for improving the present system of assessing property and eliminating the effect of unequal assessments among counties. This plan embodies the county unit plan of assessing and the separation of State revenue from the general property tax by taking as new sources of revenue a personal income tax, a gross production tax on oil and minerals, and an excise tax on the sale of nonessentials or luxuries.

An economic study of rural store credit in New York, L. SPENCER (*New York Cornell Sta. Bul.* 430 (1924), pp. [47], fig. 1).—The data summarized in these pages were obtained during the late summer and fall of 1922 in the course of personal visits made to nearly all the country retail merchants in Genesee, Tioga, and Jefferson Counties, N. Y. A complete record of the credit operations for the preceding fiscal year was obtained from 191 merchants. Additional data were obtained by means of questionnaires sent to country doctors and veterinarians and to firms selling automobiles, trucks, and tractors.

The 191 stores fell into six fairly well-defined groups, including feed, grocery and general stores, hardware, implement, and farm supply stores, and blacksmiths and country garages. Data were obtained from each store with reference to the average amounts of credit outstanding in notes and accounts receivable during the year, and it was attempted to show how the credit outstanding in 1921 compared with the normal amount.

Most country stores carry a large number of book accounts, few running higher than \$100, together with a relatively small number of notes, most of which are made for \$50 or more. Implement stores, as a rule, carry a considerable number of notes. It is shown that the greater portion of the notes taken by country merchants from their customers were discounted at the local bank, with the exception of the few cases where notes on farm implements were carried by the manufacturer.

The average net cost of credit for all feed stores, including paid and unpaid labor in keeping records, the cost of office supplies and collections, and the loss from bad accounts, was \$1,507 per store; that for general stores was \$549. The ratio of credit costs to total sales varied from 2.23 per cent for general stores to 3.85 per cent for farm-supply stores, the average for all being 2.83 per cent. The ratio of credit costs to credit sales is said to indicate that on the average credit customers should pay about 5 per cent more than cash customers.

The direct and indirect charges for credit were analyzed, and data were obtained to show the financial organization of rural stores, how this was affected by giving retail credit, and the principal sources of the credit extended by country merchants to their customers.

It is concluded that the cost to the stores of furnishing farm credit, as well as personal credit, is equivalent to twice or three times the usual charge for bank loans. Country merchants are compelled to take wider margins and to charge higher prices than they would if they were not called upon to furnish this service. The cost is paid in general by all buyers, and a system of adequate discounts for cash is urged.

The cost of living in a small factory town, C. V. NOBLE (*New York Cornell Sta. Bul.* 431 (1924), pp. [70], fig. 1).—Records of living expenses were taken in the small factory town of Groton, N. Y., largely in the households of employees of a successful manufacturing concern located there. In this survey a total of 92 records were taken which were considered satisfactory for the work in hand. Each record covers the year ended August 31, 1919.

The average family income for the year was \$2,013.43. Of this amount the husbands contributed 75.5 per cent, the wives 13.8, the children 2.2, and other members of the family 0.5 per cent. The remaining 8 per cent consisted of receipts from farms, gardens, and livestock. The family budgets are analyzed in detail. The average cost of living for the year studied amounted to \$1,659.30 per family, or \$615.83 per adult male individual. The percentage of total cash income saved increased with the family income. The 92 families saved 13 per cent of the cash income received, the average per family amounting to \$246.18. It is shown by comparison that even with a 33 per cent increase in earnings for certain New York City families they could hardly hope to save as much as did these families in the small town.

There were 13 of the Groton families included in the farm classification, i. e., those living on a farm and deriving part of their income from farm products and livestock. The average gross family income from all sources was considerably the highest for the families living on farms, although the net income was undoubtedly smaller than that of other groups.

The details of quantities, cost or value, and percentage of the cost or value of the different kinds of food used are tabulated. A bibliography of 27 titles is included.

Standard baskets for fruits and vegetables, F. P. DOWNING and H. A. SPILMAN (*U. S. Dept. Agr., Farmers' Bul.* 1434 (1924), pp. II+18, figs. 14).—The unsatisfactory situation with reference to the variations in containers is indicated by the fact that 15 styles and sizes of round stave baskets, market baskets varying in size from 1 to 24 qt., about 40 sizes of cabbage crates, 20 styles of celery crates, 30 lettuce crates or boxes, and 50 styles and sizes of hampers are in common use in the United States to-day. The need for a fixed unit as a basis for standards is pointed out. Three important shipping containers are said to be especially in need of standardization at the present time, the hamper, the round stave basket, and the market or splint basket, and some general considerations with reference to specifications are drawn up. A list is given of States which have standardized various types of fruit and vegetable containers, with type and address of the enforcing official. The publication supersedes one previously noted (*E. S. R.*, 45, p. 135).

Crops and markets, [October, 1924] (*U. S. Dept. Agr., Crops and Markets*, 2 (1924), Nos. 14, pp. 209-224; 15, pp. 225-240; 16, pp. 241-256, fig. 1; 17, pp. 257-272).—Current weekly abstracts and reviews of market reports are presented, together with tabulated data showing the receipts and prices of important agricultural commodities at the principal markets and notes with reference to foreign crops and market conditions.

Farmers' Market Bulletin, [May and June, 1924] (*North Carolina Sta. Farmers' Market Bul.*, 11 (1924), Nos. 69, pp. 11; 70, pp. 16, figs. 2).—In the first of these two numbers, an article by V. W. Lewis sets forth the tentative United States standard grades for eggs.

In the second number several short reviews are given covering the marketing of strawberries, lettuce, snap beans, and cucumbers in North Carolina during the 1924 season. Legal standards for North Carolina governing grades

for peaches are outlined. A short article is submitted by V. W. Lewis with respect to the cooperative selling of surplus poultry in carload shipments.

The usual partial list of products which farmers have for sale is appended to each number.

Supplement to agricultural cooperation: A selected and annotated reading list, compiled by C. GARDNER (*U. S. Dept. Agr., Misc. Circ. 11, Sup. (1924), pp. 22*).—A number of titles not available when the circular previously noted (*E. S. R., 50, p. 92*) was published are presented in this mimeographed supplement.

The German food situation and import requirements of bread stuffs, meats, and fats for 1924, R. H. HESS (*U. S. Dept. Agr., Bur. Agr. Econ., 1924, pp. [2]+23*).—Computations are made of the minimum food requirements of the German population until the next harvest, and it is estimated that a minimum of 830,000 tons of bread grains must be imported into Germany, as well as a minimum of 540,000 tons of beef and pork and 687,000 tons of edible fats and oils. These amounts added to the estimated domestic stocks would provide a theoretical average ration to the German population of about 110 per cent nutritive value. In order to bring the German ration up to the pre-war standard, however, another 1,000,000 tons of food imports would be required.

Economic needs of Germany and surplus farm production in America, R. H. HESS (*U. S. Dept. Agr., Bur. Agr. Econ., 1924, pp. 35*).—The surplus farm products in the United States are said to be more than sufficient to meet the German import needs noted above, and the actual and potential means of payment in Germany are sufficient to insure payment for the needed imports. The existing mechanism of foreign trade between the United States and Germany is slowed down, however, by the decline of the effective purchasing power in Germany. This is largely attributed to the lack of transportation and distributing facilities and high railway rates, the reparation obligation to levy a tax of 25 per cent on the value of all exports from the occupied area, and the American customs duties which interfere with the importation of German industrial products available in payment for exports of surplus American farm products. Certain other factors contributing to the inadequate purchasing power in Germany and the failure of foreign credits are briefly analyzed.

Summary of statistics of agricultural exports and imports to be considered in adjusting agricultural production to foreign demand, No. 2 (*U. S. Dept. Agr., Bur. Agr. Econ., 1924, pp. [3]+23*).—This mimeographed report follows an earlier one previously noted (*E. S. R., 49, p. 391*).

Monthly Supplement to Crops and Markets, [October, 1924] (*U. S. Dept. Agr., Crops and Markets, 1 (1924), Sup. 10, pp. 321-360, figs. 5*).—Estimates of the acreage and yields of principal crops are offered, with comparisons with earlier years and periods of years. The report on crop conditions for October 1, 1924, is presented, and farm prices, the receipts and disposition of livestock at important markets, cold-storage holdings, fruit and vegetable market reviews, and market reports covering milk and milk products, grain, seeds, and cotton are tabulated. Reviews of world agriculture and prices and price movements in the United States are included.

A set of index numbers of the volume of agricultural exports is featured in this number. These are based on 44 commodities comprising about 75 per cent of the value of agricultural exports from the United States. These commodities are arranged in six main groups, for which separate group index numbers are computed. Annual and monthly index numbers of the aggregative type, with annual base and monthly weights, are shown.

AGRICULTURAL EDUCATION

Statistics of land-grant colleges: Year ended June 30, 1921, L. E. BLAUCH (*U. S. Bur. Ed. Bul. 34* (1922), pp. III+67).—This report is divided into three parts, the first consisting of general information, the second containing a statistical historical survey and several summary tables, and the third being made up of the detailed tables for the year ended June 30, 1921.

Hampton's school of agriculture, A. B. DOGGETT, JR. (*South. Workman, 53* (1924), No. 11, pp. 489-498, figs. 13).—These pages give an account of the agricultural training offered and the extension teaching which is carried on from this institution.

Tuskegee's work in agriculture, B. F. HUBERT (*South. Workman, 53* (1924), No. 10, pp. 449-455, figs. 6).—The history of the development of this school of agriculture for negroes is recounted. It is now the recognized school for training negro teachers of vocational agriculture in the State of Alabama and the headquarters for the cooperative extension work for negroes carried on by the Federal Government and the State.

A type rural high school, C. A. NELSON and E. E. WINDES (*U. S. Bur. Ed. Bul. 4* (1924), pp. III+36, figs. 12).—This presents the essential details of the organization of the district, transportation of pupils, buildings and equipment, organization of the school, student body, administration, teaching staff, curricula, and vocational courses of study in a rural union high school at Mount Vernon, Skagit Co., Wash. This school district is composed of 14 separate districts. The staff includes a total of 19 teachers, including the principal, of whom 9 are men and 10 are women, all graduates of standard colleges. The courses of study in home economics, agriculture, and mechanic arts and commercial courses are outlined.

Curriculum making in home economics, W. D. ARMENTROUT, L. T. HOPKINS, and K. W. KINYON (*Vocat. Ed. Mag., 2* (1924), No. 12, pp. 990-993).—A questionnaire was submitted on the same day to all girls in junior and senior high schools in Denver, Colo. It was organized into five parts, the first dealing with activities performed daily in the home, and the others covering, respectively, the relative frequency of occurrence of various foods in home menus, the relative frequency of purchase and construction of different articles of clothing and household furnishings, the frequency of remodeling of various articles of clothing and household furnishings, and a series of general questions on home economics activities not contained in the preceding. About 5,106 students answered. Their replies are tabulated under eight headings and are thought to be suggestive of the need for instruction to be met by the curriculum.

Types of courses of study in agriculture, E. E. WINDES (*U. S. Bur. Ed., Rural School Leaflet 26* (1924), pp. 35).—An outline of a prevocational course in agriculture for grades 7 and 8 as developed for the rural high schools of Currituck County, N. C., under the direction of the author, is presented. Suggestive type lessons are offered. Also outlines are given of courses now followed in Missouri, New York, and North Carolina.

Teaching agriculture, J. B. BERRY (*Yonkers, N. Y.: World Book Co., 1924, pp. XIV+230, figs. 24*).—The author first outlines the teaching steps, which he designates as preparation, presentation, application, and testing out, giving the main emphasis to presentation and to testing out, under which he includes the home project, supervised farm jobs, project records and reports, and recitation and discussion on the job. A chapter is given to a discussion of the desirability of a course of study allowing for sufficient flexibility to meet community needs, and this is followed by a chapter suggesting the means of

carrying out a community survey for the purpose of determining such needs. Chapters are also given to the teaching plan, the lesson plan, the use of the school period, organizing school and class projects, and grading. The last two chapters are devoted, respectively, to educational objectives and the school and community work of the teacher of agriculture. Appendixes give suggestive outlines, forms, and other material.

Elements of rural economics, T. N. CARVER (*Boston and London: Ginn & Co., 1924, pp. V+266, pls. 5*).—Rural economics is defined as that branch of the science of statesmanship which deals with agriculture and rural life as factors in nation building, and the importance of taking a public point of view is emphasized throughout this elementary textbook. The chapters are on the subjects of the relation of rural economy to nation building, economizing the soil, the farmers and the land, the expansion of farming in the United States, the farmer and his work, the farmer and his capital, the economical organization of the farmer's business, the agricultural income, marketing farm products, cooperation among farmers, and organization for rural living.

MISCELLANEOUS

[**Annual Report of Florida Station, 1923**], W. NEWELL ET AL. (*Florida Sta. Rpt. 1923, pp. 140+VII, figs. 21*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1923, a general review of the work of the station during the year, and departmental reports, the experimental features of which are for the most part abstracted elsewhere in this issue.

[**Third and fourth annual reports of Georgia Coastal Plain Station, 1922 and 1923**], S. H. STARR (*Georgia Coastal Plain Sta. Buls. 3 (1923), pp. 23, figs. 2; 4 (1924), pp. 44, figs. 16*).—These bulletins contain the organization list and a report of the director on the work of the station during the respective years. The experimental work reported is for the most part abstracted elsewhere in this issue.

Report of the Guam Agricultural Experiment Station, 1922, C. W. EDWARDS and J. GUERRERO (*Guam Sta. Rpt. 1922, pp. 20, pls. 6*).—This contains reports of the animal husbandman in charge, the assistant in agronomy and horticulture, and the extension division, and meteorological observations. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Thirty-sixth Annual Report [of Mississippi Station], 1923, J. R. RICKS ET AL. (*Mississippi Sta. Rpt. 1923, pp. 63*).—This contains the organization list, a report of the director on the work of the station, a financial statement for the fiscal year ended June 30, 1923, and departmental reports, the experimental work in which is for the most part abstracted elsewhere in this issue.

Thirty-seventh Annual Report of the Pennsylvania Agricultural Experiment Station, [1924], [R. L. WATTS] (*Pennsylvania Sta. Bul. 188 (1924), pp. 31, figs. 2*).—This bulletin discusses briefly the work of the station for the year ended June 30, 1924, including a financial statement for this period. The experimental work recorded is for the most part abstracted elsewhere in this issue.

NOTES

California University and Station.—Ira J. Condit, from 1913 to 1919 instructor and assistant professor of citriculture and subsequently in commercial work, has returned to the institution as associate in subtropical horticulture in the College of Agriculture, with headquarters at Berkeley. Considerable experimentation with figs and olives, as well as instruction work, is contemplated.

Colorado College.—L. P. McCann has been appointed associate professor of animal husbandry vice B. W. Fairbanks.

Delaware Station.—P. B. Meyers has been appointed chemist vice L. W. Tarr, resigned.

Florida University.—Recent resignations from the extension division include those of H. B. Lansden, poultry specialist, and John R. Springer, field specialist in the control of insects of fruit and truck and truck diseases. The first-named position was filled December 15, 1924, by the appointment of Norman R. Mehrhof of South Carolina.

Michigan College and Station.—The college has recently taken over the Dunbar Agricultural School property. This property, originally donated by Chippewa County, is located in the Upper Peninsula of Michigan at Dunbar, which is about 20 miles south of Sault Sainte Marie. It contains 560 acres of land and will be used principally as a farm demonstration unit and possibly for some experimentation in forestry. No class work is to be carried on, with the possible exception of a summer forestry camp.

Effective control of the red spider on plants in the greenhouses has been secured by the entomological section through spraying with a standard strength of lemon oil on each of three days in succession. The success is attributed to the successive sprays.

A year's test of alfalfa as a feed for horses was completed in December, 1924. During the year the alfalfa and corn fed horses made an average gain of 21 lbs. each, while the corn, oats, and timothy fed horses lost an average of 17 lbs. per head. The cost was 31 cts. per day for feed or 6 cts. per hour of work with the horses fed alfalfa and 37 cts. for feed or 7 cts. per hour of work with the horses fed timothy.

J. F. Cox, head of the farm crops department, has been granted leave of absence from January 1 to May 1 to assist the Federated Seed Service, located in Chicago.

Mississippi College.—According to a note in *School and Society*, Dr. B. M. Walker, vice president of the college, has been appointed president, succeeding Dr. D. C. Hull who has resigned, effective July 1.

Cornell University.—Dr. R. A. Emerson, head of the department of plant breeding of the College of Agriculture, has been elected dean of the university graduate school. This is the first time that a member of either the station staff or of the college faculty has held this position.

North Carolina College.—L. J. Pessin, Ph. D., has accepted a position as assistant professor of botany.

North Dakota College and Station.—John Taylor has been appointed instructor in dairy manufactures in the college and assistant in the station.

EXPERIMENT STATION RECORD

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In the passage of the Purnell Act, signed by President Coolidge February 24, 1925, research in agriculture has received a new indorsement and impetus. Trebling as it will in a few years the Federal grants for the State experiment stations, the act marks the culmination of several years of effort to place these institutions on a basis where they may more adequately meet the growing need for additional investigation. The unanimous approval of the measure by the committees and on the floors of Congress when the measure was brought up for consideration, and the subsequent provision of funds in the closing days of the session to put it into operation on July 1, make the recognition of the stations the more impressive.

The increase in support provided for by the Purnell Act is a gradual one, in order that preparation may be made for the expansion. Starting with an initial appropriation of \$20,000, the amount is to increase by \$10,000 a year until it reaches \$60,000 to each State in the fiscal year 1930. Thereafter the annual appropriation is to be of this amount. This is in addition to the \$30,000 now provided under the Hatch and Adams Acts, making a total of \$90,000 per annum from the Federal Government or an aggregate of \$4,320,000 to the 48 States. Even if there should be no material increase in the State support, the total from Federal and State sources would approximate \$13,000,000.

This is an enormous amount for research in the interest of the agricultural industry, especially since it is supplemented by large appropriations for corresponding activities of the Federal Department of Agriculture. So far as known, no single industry has ever had the benefit of such generous provision, certainly not from the public funds. It is equal to the income of an endowment of a quarter of a billion dollars at 5 per cent; but it is to be recalled that the agricultural industry is the largest productive industry, yielding an output valued at the farm at approximately \$13,000,000,000 last year.

The effective use of such a vast sum in research is a large responsibility. It calls for a high degree of ability in management, an organization responsive to the needs and capable of so functioning as

to present a united attack, and a personnel commensurate with the best attainable. The problems to be met are of increasingly difficult character, calling for more and more fundamental and complete information to understand and solve them, and changed conditions necessitate new lines of study.

The Purnell Act broadens the field of research for the stations. In addition to questions relating to agricultural production, those of marketing and other branches of economics, the rural home, and rural life now find specific mention. This definitely extends the scope to include the welfare of all who are living in a rural environment, including home economics, sociology, and other cognate matters pertaining to the conditions under which agriculture is carried on.

The authorization is now for "such scientific researches as have for their purpose the establishment and maintenance of a permanent and efficient agricultural industry." This is so broad as to be far-reaching indeed in its significance, but obviously no single station can undertake to cover the whole field. In fact, since the new act is designed to add to and strengthen the work of investigation, it will be important that the work undertaken under its provisions should represent definite pieces of investigation of substantial character, such as are called for in the present stage of agricultural inquiry, and should not be spread over too broad a range.

The Purnell Act affords an exceptional opportunity for enlarging and making more effective the investigations of the experiment stations. It carries with it an expectation and responsibility which should be met by these institutions in the fullest possible measure. This will imply a studied effort to put the new resources to the most effective use in helping to solve the outstanding problems of American agriculture and country living.

The practice of presenting each year in these columns an interpretation of the successive acts making appropriations for the support of the Federal Department of Agriculture is essentially as old as the *Record* itself. It has been continued without interruption in the belief that there is general interest in the information thereby afforded regarding the prospective financial resources and lines of development of the Department. The various acts provide a basis of comparison for a period of years, but for one reason or another it seldom happens that one act can be safely compared directly with another without more or less explanation.

The latest of these measures, signed by President Coolidge February 10, and making appropriations for the fiscal year ending June 30, 1926, is no exception in this respect. Although in general appearance it resembles its predecessors and especially that for the previous year, there are several complicating elements which without interpretation might be quite misleading. Thus the appropriations

in the new act aggregate \$124,774,441, an apparent increase of \$66,199,167, or 113 per cent. Manifestly such an increase, if applicable to those activities of the Department most commonly associated with it in the public mind, would indicate a contemplated expansion of work of unusual proportions, especially under conditions like the present when great efforts are being directed toward economy and a reduction of expenditures.

As a matter of fact, the real situation is simply that \$80,000,000 is allotted to meet the quota of the Federal Government in the cooperative construction of roads under the Federal highway act, whereas in the year previous but \$19,000,000 was so allotted. There is also an increase of \$939,560 for such conservation items as the cooperative fire protection and the acquisition of lands for forestry and a wild life and fish refuge. On the other hand, certain large emergency appropriations necessitated in 1924-25 for combating outbreaks of animal diseases and forest fires have not been duplicated. Eliminating all items of this type, but including supplementary deficiency appropriations and similar provisions, the respective resources for the regular work of the Department for the fiscal years 1925 and 1926 are \$44,993,996 and \$45,614,441, a net increase of \$620,445, or about 1.5 per cent.

In each case, however, account must also be taken of the so-called continuing appropriations not requiring annual action by Congress. These include such items as the \$3,000,000 fund for the Federal meat inspection, \$4,580,000 for extension work under the Smith-Lever Act, and \$4,760,750 for various forestry purposes. These items show no substantial change from the previous year.

Still another complicating fact is presented by the deficiency appropriations. The new appropriation act is based on estimates originally formulated by the Department in August, 1924, and the bill itself was made up and passed by the House of Representatives as early as December 11. A deficiency act was framed several weeks later and signed March 4, 1925, and this contains an unusual number of supplementary appropriations for the Department, some for the fiscal year 1925 and others available in 1926. In the latter class is \$960,000 for the initial payment to the States under the Purnell Act. Taken collectively, these appropriations will swell the 1926 funds for the Department, including the road items, to \$145,709,191.

A recent analysis of these figures shows that somewhat over \$12,000,000 of this amount will be available for what may be termed research work, approximately \$8,000,000 for extension work, slightly under \$10,000,000 for regulatory work, nearly \$8,000,000 for the control and eradication of plant and animal diseases, about \$81,500,000 for road and trail construction, and about \$23,000,000 for other public service such as the administration of the national forests,

the weather forecasts, crop estimates and reports, the market news service, and the market inspection of perishable foods. For the fiscal year 1915, it is of interest to note, the total for all purposes was slightly under \$30,000,000. During the intervening period the funds for plant and animal pest control campaigns have been approximately doubled, while the appropriations for research have been increased by over \$5,000,000 per annum, for extension work by nearly \$6,000,000, and for regulatory work and other public service by about \$5,000,000 each.

The net increase of \$620,445 for ordinary activities represents the difference between additional allotments of \$1,028,868 and reductions of \$408,423, the changes being distributed through a considerable range of projects. The principal increases consist of \$200,994 additional for tuberculosis eradication, \$160,000 additional for preventing the spread of the European corn borer, and \$149,840 additional for combating the gipsy and brown-tail moths. One of the largest reductions results from a restricting of the maximum amount which can be expended from the lump funds of the various bureaus and offices for salaries in Washington. This change is expected to bring about a decrease of about \$100,000 in the expenditures for this purpose, with a consequent reduction in the Washington force. Another large item is a decrease of \$101,670 in the allotment for combating the pink boll-worm of cotton.

Comparison of specific items, whether for a single project or for an entire bureau, is also complicated by the fact that in the new act the funds provided in each case cover the increased compensation of the field employees of the Department under the reclassification which became effective July 1, 1924. This element does not appear in previous appropriation acts for the Department, the funds for this purpose in the present year being provided in a special measure carrying \$3,541,162, so that many apparent increases in allotments are due to this factor alone. Such a condition obtains, for example, in the Weather Bureau, its new appropriation of \$2,343,192 being an apparent increase of \$318,157 but an actual decrease of \$9,343, since \$327,500 is required for the increase in field salaries.

Taking up the various branches of the Department in turn, the Office of the Secretary receives \$6,727,047. This includes as its principal items the usual payment of \$1,440,000 to the States under the Hatch and Adams Acts, \$1,300,000 for the supplementary extension work under the Smith-Lever Act, and \$1,308,540 for the Department's own cooperative demonstration work. No change is made in the allotment of \$738,000 for the Department's printing and binding nor in its rent bill in the District of Columbia of \$209,866. Although legislaion looking toward the provision of permanent quarters was again deferred, authority is given the Department to

enter into long-term leases for two large structures in the general neighborhood of the Department's main buildings.

The general funds available for the Office of Experiment Stations are fixed at \$104,566, of which not more than \$99,866 may be expended for salaries in the District of Columbia. This is substantially in accordance with the present resources, as is also the grant of \$230,680 for the insular experiment stations. Because of the completion of certain improvements, small decreases are made in the funds for the Hawaii and Virgin Islands Stations, and there is also a reduction of \$400 for the Porto Rico Station. The Guam Station receives \$3,000 additional for entomological work in combating the coconut scale, and the deficiency act extends a previous appropriation of \$8,000 for this campaign until June 30, 1926.

The new appropriations for the Bureau of Animal Industry aggregate \$8,385,156, and these are as usual supplemented by the \$3,000,000 permanent appropriation for meat inspection. The increase of \$200,994 in the funds for tuberculosis eradication, already referred to, is a result of large appropriations which are being made under a cooperative understanding by the States, aggregating in 1924 \$6,112,500. It is of interest to note that in that year 5,312,304 cattle were tested, of which 171,559 were reactors, and that the number of accredited cattle has now reached 920,370.

The fund for the eradication of the cattle tick is reduced by \$17,623, that for hog cholera eradication by \$17,050, and that for inspection and quarantine work by \$35,960. Steady progress is reported in the tick campaign, the State of Georgia having been released from quarantine late in 1924 and leaving for the entire region under quarantine only 275 of the 975 counties originally infested. The reduction in the quarantine funds consists largely in the elimination of \$30,000, reappropriated last year after a lapse of several years, for the purchase and distribution of blackleg vaccine, very few demands having been received for this material.

Provision is made in the deficiency act for expending not to exceed \$75,000 of the \$3,500,000 granted December 5, 1924, for the eradication of foot-and-mouth disease in special studies of this disease with a view to discovering new methods of prevention and suppression. This appropriation is available until June 30, 1926.

For animal husbandry work an increase of \$22,225 is granted, to be used for rehabilitating the Fort Keogh Remount Station, at Miles City, Mont. This reservation, containing approximately 60,000 acres, was transferred by Congress to the Department in an act approved April 15, 1924, and is expected to be developed as a range experiment station under the supervision of the bureau.

The new Bureau of Dairying receives \$496,640, a net increase of \$4,969. Its activities are not subdivided in the law but are organized

into over 25 projects, of which the largest continues to be the supervision and maintenance of the experiment farm at Beltsville, Md., for which \$79,008 is allocated. Other important projects provided for are \$29,819 for studies of the nutrition of dairy cows, \$22,595 for dairy sanitation research, and \$22,506 for studies of dairy cattle breeding. Authority is also conveyed in the deficiency act to purchase a tract of about 129 acres of leased land adjoining the Beltsville farm, utilizing not to exceed \$13,100 of the funds available for the fiscal year 1925.

There are increases of \$110,219 and decreases of \$66,801 for the Bureau of Plant Industry. Its new total is \$3,881,073 or, including two deficiency items subsequently allowed, \$3,922,073. A reduction of \$36,315 in the funds for barberry eradication is offset by allotments of \$16,975 for breeding rust-resistant wheats and \$19,340 for general cereal investigations. Increased attention is to be given to work with sugar plants, \$5,000 additional being allotted to develop blight-resistant strains of sugar beets and \$31,000 in the deficiency appropriation for similar work with sugar cane. Of the latter allotment not to exceed \$8,000 may be used for the construction of a greenhouse at the Arlington Experiment Farm and not to exceed \$16,000 for land and buildings at Canal Point, Fla.

The allotment for pomological investigations is increased by \$12,500, of which \$5,000 is for study of apple handling problems in Virginia and the remainder for studies of fruit growing and handling in California. In the latter work it is expected to establish a small field station in the Santa Clara Valley and to give special attention to the handling of apricots.

An increase of \$5,000 in the allotment for studies of plants yielding drugs, spices, and related products is provided for plant physiological investigations and the study of plant geography in its relations to plant industry. There is also an increase of \$2,965 for additional testing of imported red clover seed.

The pathological work of the bureau on forest diseases receives increases of \$15,000 for the white pine blister rust campaign, \$2,095 for pathological studies at forest experiment stations, and \$9,905 for a chestnut blight survey. For the blister rust work a total of \$348,280 is provided, and it is expected that this will be supplemented by large appropriations from at least 10 States and other co-operators, these sources supplying \$203,078.85 for the fiscal year 1924. The chestnut blight disease has now destroyed practically all stands of chestnut north of the Potomac River, and the studies projected are primarily to utilize as profitably as possible the acreage remaining in the States to the southward.

The Forest Service receives \$8,193,915, together with \$1,000,000 for the acquisition of additional lands at the headwaters of navi-

gable streams, \$660,000 for cooperative forest fire prevention and suppression, \$50,000 for assistance to farm owners in forest problems, and a like amount for the cooperative distribution of forest plant stock. The last two items appear for the first time and are to carry out the provisions of the reforestation act of June 7, 1924. There is also made available \$4,000,000, a decrease of \$2,000,000, for the construction of forest roads and trails under the Federal highway act. These various appropriations, coupled with \$4,760,750 from the permanent appropriations, make a total of \$18,724,665 for forestry work. The expenditures will as usual be offset to a considerable degree by the receipts from the national forests, which in 1924 amounted to \$5,251,903.

The principal single item to be increased is that for the acquisition of forest lands, for which \$181,460 additional is provided. The funds for fire protection are augmented by \$80,000, of which \$50,000 is allotted for cooperation with the War Department in airplane control.

The Bureau of Entomology receives much the largest increase of any bureau, its total rising from \$2,153,638 to \$2,554,743. The increase is divided among 10 projects, of which the principal items have already been mentioned. The smaller increases include \$20,000 for combating the blueberry maggot and peach insects, \$11,410 for the western bark beetle, \$7,500 each for the cotton hopper and the Arizona cotton weevil, \$5,000 each for the alfalfa weevil and a group of berry insects, and \$2,615 for research on methods for preventing the spread of the Mexican bean beetle.

The appropriations under the Bureau of Biological Survey aggregate \$1,372,768, but \$400,000 of this is to be used for the acquisition of land for an Upper Mississippi River Wild Life and Fish Refuge provided by an act of Congress approved June 7, 1924. Authority is also given the Department to enter into contracts for additional land under this project with a contemplated ultimate expenditure of \$1,500,000. The net increase for the bureau for other purposes is \$13,228, mainly for administrative duties.

For the Bureaus of Chemistry, Soils, and Home Economics net increases are provided of \$5,998, \$12,260, and \$10,220, making their respective totals \$1,502,188, \$403,860, and \$117,244. The increases for the Bureau of Chemistry are in connection with the enforcement of the food and drugs act and the naval stores act. For the Bureau of Soils \$14,000 additional is granted to permit of certain salary readjustments in connection with the soil surveys. The increase for the Bureau of Home Economics is to be devoted to an expansion of the studies of the home preservation of food, with special reference to botulinus poisoning, the development of its

new division of clothing and textiles, and additional cost of living surveys as a basis for work on household budgets and accounts.

For the first time in many years, the appropriations for the Bureau of Agricultural Economics show a small net reduction, its total falling from \$4,758,742 to \$4,738,056. This is partly because of decreases of \$15,174 in the fund for studies of farm management and practice and \$5,885 in the allotment for the market inspection of perishable foods. A partial offset appears in increases of \$10,000 for the market news-service on livestock and of \$8,000 for additional expenses under the U. S. warehouse act.

Other branches of the Department's work for which the total appropriations are curtailed include the Library, reduced from \$70,960 to \$68,180, and the Bureau of Public Roads from \$492,195 to \$484,964. The funds for the last named bureau are decreased by \$4,500 for road management surveys and \$5,749 for road building and maintenance studies, but there is an increase of \$10,000 in the allotment of \$207,170 for rural engineering investigations to permit of studies of machinery suitable for distributing concentrated fertilizer materials. There is also a net decrease of \$83,804 in the appropriation of \$756,110 for the Federal Horticultural Board, largely because of the reduced allotment for combating the pink bollworm of cotton already referred to. The Insecticide and Fungicide Board receives \$200,975, an increase of \$20,000 for additional expenses under the insecticide act; the Packers and Stockyards Administration \$480,000, an increase of \$4,320; and for the seed grain loan collections there is allotted \$24,000, an increase of \$4,685. The appropriation for the Grain Futures Administration of \$111,530 is continued unchanged, and the total for the Division of Accounts and Disbursements is increased from \$74,440 to \$78,460.

Most of the changes in allotments, it will be observed, are relatively small. When due allowance is made for the various complicating factors, the new act is largely a routine measure, differing very little for most items from those which have preceded it in the past three or four years. It contains practically no general legislation, and while there are numerous exceptions the bulk of the allotments correspond closely to the budget estimates and the present appropriations. Such increases as have been allowed quite commonly provide for an enlargement of the control work for specific pests and diseases or the more complete enforcement of regulatory measures. The new research projects authorized are very few in number, but those already in progress are continued, as a rule, without material alteration. In a general way, there is little change in the conditions which have characterized the Department's work in recent years, and no radical modification in its policies and programs as a result of this legislation is to be anticipated.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Chemistry in industry, edited by H. E. HOWE (*New York: Chemical Foundation, Inc.*, 1924, pp. XII+372, pls. 35, figs. 4).—As stated in the editor's foreword, this volume constitutes "a symposium, to which 21 specialists in as many different industries have contributed chapters dealing with what chemistry has accomplished in their field of work and noting several unsolved problems to indicate a few of the many opportunities that await the resourceful, well-grounded chemist." Among the subjects included are Alcohol and Some Other Solvents, by D. B. Keyes; Coal, Coke, and Their Products, by F. W. Sperr, jr.; Cotton and Cotton Products, by T. C. Law; Chemistry in the Fertilizer Industry, by R. B. Deemer; The Making of Leather, by J. A. Wilson; Chemistry of Packinghouse Processes, by W. D. Richardson; Chemistry in the Pulp and Paper Industry, by M. A. Krimmel; Perfumes and Flavors, by S. Isermann; and Chemistry in the Textile Industry, by L. A. Olney.

The plant alkaloids, T. A. HENRY (*London: J. & A. Churchill*, 1924, 2. ed., pp. VIII+456, pls. 8).—In this revision of the volume previously noted (E. S. R., 29, p. 503), considerable attention has been given to the relationship between chemical constitution and pharmacological action among the alkaloids.

The deterioration of soap-nicotine preparations, C. C. McDONNELL and E. J. NEALON (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 819-821, fig. 1).—To determine the cause of loss of nicotine from nicotine-soap preparations used as insecticides, a number of nicotine soaps were prepared, packed in various types of containers, and analyzed annually for four years. The soaps were all prepared from menhaden oil with the same amount of nicotine, and included a neutral soap prepared with sodium hydroxide, a sodium hydroxide soap containing free alkali, and a soft soap prepared with potassium hydroxide. Samples of the two hard soaps were packed in wax paper, others sealed in mason jars, and others in tin cans fitted with pressed tin covers. The soft soap was packed in mason jars and tin cans.

When examined after a year, it was found that the nicotine in the two hard soaps had decreased to less than half the original amount. The change in the wrapped cakes was less than in those in Mason jars and in tin cans. In the soft soap no loss of nicotine occurred after two years' and very little after three years' storage. The samples in which a loss of nicotine had occurred were found to contain a black resinous material insoluble in water and ether. None of this material was present in the samples in which no loss of nicotine had taken place.

To determine whether the loss of nicotine in the hard soaps was due to heat applied in making the soap, the alkali used, or the physical condition of the soap, a semisolid sodium soap was prepared by the cold process and some of this was diluted to the same consistency as the soft potassium soap. Both were analyzed at the end of one and four years and were found to retain their original nicotine content.

These results indicate that soap-nicotine preparations should be in the form of soft soap in order to preserve the original nicotine content.

A new micromelting point apparatus, J. F. CLEVENGER (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 854, 855, figs. 3).—A new micromelting point apparatus, devised at the Bureau of Chemistry, U. S. D. A., for work on the microsublimation of plant products, is described and illustrated.

The apparatus is made of brass in two separable parts, the heating unit and the object unit. The former consists essentially of two electric heaters controlled by a three-heat switch. Between the heaters is a heat conductor projecting from one side and fitting into a slot in the object unit when the apparatus is in operation. The under part of the object unit contains an air chamber to reduce heat conduction and prevent damage to the stage of the microscope. The apparatus is said to be capable of determining melting point temperatures up to 400° C.

Platinized alundum cathodes in electroanalysis, W. G. FRANCE and T. S. ECKERT (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 802, 803).—An investigation of the possibility of using platinized alundum as material for cathodes is reported with the conclusion that it is unsuitable for such use on account of the following facts: High currents can not be used, it is impossible to obtain constancy of weight, it is necessary to use glass-stoppered bottles for weighing on account of rapid adsorption of water vapor from the air, a long time is required for washing and drying, and the platinized surface brings about rapid oxidation of the deposited metal.

Turbidimetric estimation of precipitates, P. L. HIBBARD (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 804, 805, figs. 2).—A simple turbidimeter, which is said to give results comparable in accuracy to the ordinary colorimeter, is described and illustrated, with directions for preparing the precipitates for the turbidimetric determinations of calcium, magnesium, and sulfate. The necessity is emphasized of producing precipitates of uniform physical character for turbidimetric analysis.

A comparison of several qualitative tests for soil acidity, H. J. HARPER and H. G. M. JACOBSON (*Soil Sci.*, 18 (1924), No. 2, pp. 75-85).—A comparative study is reported from the Iowa Experiment Station of several qualitative tests for soil acidity as applied to 51 soils from Wisconsin, Missouri, Illinois, and Iowa. The tests included "Soiltex" as recommended by Spurway (E. S. R., 51, p. 15), the Truog test (E. S. R., 43, p. 622), the Comber test (E. S. R., 46, p. 615) and a later modification using potassium salicylate in place of potassium thiocyanate (E. S. R., 49, p. 407), "Richorpoor" (another modification of the Comber test), and the Iowa test as developed by P. Emerson.¹ The last-named test is also a modification of the Comber test and includes the use of a saturated solution of neutral ammonium molybdate in ether when moist soils are to be tested. The LaMotte indicator field set, recommended by Wherry (E. S. R., 44, p. 418), was also tested but found unsatisfactory on account of the time required to secure clear soil extracts. The pH values of all the soils were determined electrometrically on suspensions prepared by shaking 50 gm. of the soil and 100 cc. of distilled water in an Erlenmeyer flask for 20 minutes. The Truog method of expressing acidity was used in the tabulated results.

Where clear solutions could be obtained, the results obtained with Soiltex agreed fairly well with the H-ion concentration. With peat and heavy clay soils extracts could not always be secured which were clear enough for comparison with the Soiltex reaction chart. The results obtained with the Truog

¹ Jour. Amer. Soc. Agron., 15 (1923), No. 12, pp. 495-499.

test did not agree as well with the H-ion concentration as those obtained with Soiltex on account of the fact that the Truog test is a measure of total acidity rather than H-ion concentration. The Truog test requires more equipment and more time than the other tests, but is considered more accurate. The Comber thiocyanate test and its modifications as at present applied are thought to be open to criticism on account of the fact that the same amount of material is not always measured.

The last four tests measure replaceable iron rather than soil acidity. In loams, silt loams, and the heavier soils, the results obtained compared favorably with the H-ion concentration, but in sandy soils the results were too low. The potassium salicylate modification required more time than the other tests measuring replaceable iron.

In a second series of tests in which the same samples were tested dry and with varying amounts of moisture, satisfactory agreement was secured with Soiltex, the Truog test, and the Comber potassium salicylate test. With soils containing less than 20 per cent of moisture, the Iowa test gave accurate results, but the Richorpoor test was unsatisfactory except on dry soils.

A study was finally made of the colors produced by extracting a given soil with different organic solvents containing 1 per cent of potassium thiocyanate. Different colors were obtained with the different solvents, and more iron was dissolved by some than others. Ethyl acetate replaced the largest amount, acetone next, and methyl and ethyl alcohol much less. Acetone is considered to be the best solvent as it does not dissolve iron from neutral and basic soils, is less affected by moist soils, and forms a more stable solution with potassium thiocyanate.

The rapid determination of available phosphate in soil by the coeruleo-molybdate reaction of Denigés, W. R. G. ATKINS (*Jour. Agr. Sci. [England]*, 14 (1924), No. 2, p. 192-197).—The author has applied the Denigés cerulean molybdate method (E. S. R., 47, p. 714) to the determination of the amount of phosphate yielded by soil at its own pH value.

For the determination, 10 gm. of air-dried soil passed through a 100-mesh sieve is shaken for 3 or 4 hours with 50 cc. of conductivity water and about 10 cc. of the resulting liquid is centrifuged until clear. Of this, 5 cc. is made up to 100 cc. and mixed in a stoppered cylinder with 2 cc. of reagent A, followed by 5 drops of reagent B. Reagent A consists of a mixture of 100 cc. of 10 per cent ammonium molybdate with 300 cc. of 50 per cent (by volume) sulfuric acid. Reagent B is a stannous chloride solution prepared by warming 0.1 gm. of tin with 1 drop of 4 per cent copper sulfate solution and 2 cc. of pure hydrochloric acid, and making the mixture up to 10 cc. Reagent A must be stored in the dark and reagent B prepared fresh each day. The color is compared with a standard phosphate solution equivalent to 0.05 mg. of P_2O_5 per liter by pouring both solutions into 100-cc. Hefner cylinders and allowing the liquid in one to run out until the colors match.

Two possible sources of error are pointed out, with means for avoiding them. Reagent A sometimes develops a faint blue color when exposed to light. This is allowed for by blank estimations with distilled water. Some soils give slightly colored extracts which impart a greenish hue to the blue liquid. Difficulty in matching color in such cases is obviated by adding a few drops of a dilute solution of Bismarck brown to the standard.

Data obtained by the method as described are presented on the content of water-soluble phosphorus calculated as parts per million of P_2O_5 on air-dried soil, 1:5 extract, after extraction of the soil for from 3 to 4 hours and for several days, respectively. The pH values of the soil extracts are also given.

The P_2O_5 values were for the most part under 2 parts per million unless the soil was enriched artificially. No correlation was indicated between the amount of water-soluble phosphorus and the soil reaction. Extraction for 3 or 4 hours gave values as high as extraction for from 4 to 7 days with ordinary soils of low phosphate content, but with richer soils there was evidence of a reversion to an insoluble form during prolonged extraction.

The Denigés method is recommended as being much more rapid than the Official method of precipitation with ammonium molybdate and as being suitable to extremely dilute solutions.

Tables for converting crude protein and ash content to a uniform moisture base, J. H. SHOLLENBERGER and D. A. COLEMAN (*U. S. Dept. Agr., Misc. Circ.* 28 (1924), pp. 30).—This circular contains tables for converting crude protein and ash values obtained in analyses of wheat and flour of a moisture content varying from 0 to 16.9 per cent to a uniform basis of 13.5 per cent. This value was selected because it corresponds closely to the normal amount of moisture in wheat and flour from many sections of the country and because it is the maximum percentage of moisture allowed in flour under the Federal food and drugs act.

A table is also given of the percentages of crude protein in wheat and flour computed from the percentages of total nitrogen found, using the conversion factor 5.7.

The Van Slyke method for the determination of amino-acid nitrogen as applied to the study of bacterial cultures, R. W. LAMSON (*Jour. Bact.*, 9 (1924), No. 3, pp. 307-313).—The Van Slyke micro method of determining amino nitrogen has been applied to bacterial culture media, and the results have been subjected to statistical analysis. The data obtained indicate that the method is very unsuitable to such media. Similar conclusions reached by other investigators are cited in confirmation of this conclusion.

The detection and determination of small quantities of pyruvic acid [trans. title], L. J. SIMON and L. PIAUX (*Bul. Soc. Chim. Biol.*, 6 (1924), No. 5, pp. 477-487).—Several methods of determining pyruvic acid have been studied, and of these two are recommended as giving satisfactory results—a colorimetric method using sodium nitroprusside, ammonium hydroxide, and acetic acid, and a volumetric method depending upon the acid reaction of the hydrazone formed from pyruvic acid and phenylhydrazine hydrochloride or preferably *p*-bromophenylhydrazine hydrochloride. The colorimetric method is said to be the more rapid of the two and the phenylhydrazine the more accurate.

The first method, when used simply to detect the presence of pyruvic acid, consists in mixing 1 cc. of the solution to be tested, 0.5 cc. of a 40 per cent solution of acetic acid, 3 cc. of a freshly prepared solution of sodium nitroprusside, and 1.5 cc. of a 1:1 solution of ammonium hydroxide. If the solution contains 1 per cent of pyruvic acid, a blue color is said to appear in 2 minutes and if 2 per cent in 10 minutes. If no color appears, the test is repeated, using 1 cc. of nitroprusside. In adapting the test to quantitative use, the length of time before the color appears is used as a rough means of selecting the appropriate standard for comparison in a Duboscq colorimeter. In the phenylhydrazine test, the crystallized hydrazone is titrated with a known volume of a standard solution of sodium hydroxide, with phenolphthalein as indicator.

In connection with the study, attention is called to the instability of alkaline pyruvates in solution and the stability of the free acid under the same conditions, and the difficulty of separating pyruvic acid from lactic acid by ether extraction.

Color reactions of fat-soluble factors [trans. title], [N.] BEZSSONOFF (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 12, pp. 572-574).—The author's color test for vitamin C (E. S. R., 51, p. 714) is considered to be applicable as well to the detection of the growth-promoting vitamin A and the antirachitic vitamin.

The test as applied to cod liver oil consists in diluting the oil with 2 parts of benzene, adding 12 drops of the reagent, and shaking. With perfectly fresh cod liver oil the water layer on separating is said to be intensely blue and the oil layer colorless, while with old oil the water layer is colorless or slightly gray and the oil layer orange. The orange color is considered to be due to the antirachitic vitamin and the blue, which is very fleeting, to vitamin A. On heating the material, the orange color is intensified and the blue disappears. Dried egg yolk extracted with benzene is said to give a pronounced yellow or orange color, and fresh butter a blue test with practically no yellow even on heating. Olive oil, peanut oil, and lard are said to give no color reaction, with the exception of a slight blue color disappearing rapidly in unheated olive oil.

The influence of certain factors on the hydrogen ion concentration of milk.—II, **Temperature changes**, E. DUNCOMBE (*Jour. Dairy Sci.*, 7 (1924), No. 3, pp. 245-248).—In connection with the study reported on page 376, milk from the same cows was used to determine the effect of temperature on the H-ion concentration and total acidity of the milk. The H-ion concentration was determined electrometrically, and the acidity first by titrating with $N/10$ NaOH, using phenolphthalein as indicator, and later by the method of Van Slyke and Bosworth (E. S. R., 32, p. 606).

Increase in temperature caused an increase in both total acidity and H-ion concentration whether samples previously neutralized or fresh were used for the determinations.

The relation of natural acidity in milk to composition and physical properties, F. E. RICE and A. L. MARKLEY (*Jour. Dairy Sci.*, 7 (1924), No. 5, pp. 468-483).—In this extensive investigation acidity was determined by titrating 20 cc. of undiluted milk with $N/10$ NaOH, using as indicator 1 cc. of neutralized phenolphthalein (5 gm. in 1 liter of 50 per cent alcohol), and calculating the results in terms of percentage of lactic acid. Samples of milk from a large number of cows were titrated, and those covering the widest range of values were analyzed for various constituents with the following results:

With decreasing acidity there was a general but irregular decrease in specific gravity, total solids, solids-not-fat, lactose, protein, and casein, a more regular decrease in P_2O_5 , and no consistent changes in albumin, citric acid, ash, alkalinity of ash, and CaO.

There appeared to be no distinct relation between the acidity of the milk and its content of CO_2 , samples of low acidity even containing more CO_2 than those of high acidity. Under average conditions the acidity due to CO_2 was found to amount to from 0.01 to 0.02 per cent of the total acidity calculated as lactic acid. Similarly, the acidity due to acid citrates is calculated as 0.01 per cent, to casein from 0.05 to 0.08 per cent, and to albumin less than 0.01 per cent of the total acidity. The difference between the total acidity and the sum of these factors is attributed to phosphates. Determinations of the total acidity and of the P_2O_5 content of the original milk and the serum obtained by filtration through a Pasteur-Chamberland filter showed this to be true, since practically the entire differences in the acidity of the different samples were in the serum.

Determinations of the H-ion concentration of untreated milk of varying acidity and of the same samples after the addition of 8 cc. of N/10 HCl and NaOH, respectively, to 92 cc. of milk showed that with increase in acidity, as determined by titration, there was an increase in the H-ion concentration. The pH values of high acid milks were changed much less than of low acid milk, an argument against the use of H-ion concentration determinations as a means of determining the degree of souring.

Dilution was found to reduce the acidity of the milk and to have a more marked effect upon samples of high than of low acidity. Evidence was obtained that this was due to both phosphates and caseinates. Samples of widely varying natural acidity were remarkably constant in osmotic pressure and freezing point. This is shown to be due to the balance between chlorides and lactose, the former being high in low acid milk in which the lactose was low. The conductivity ran parallel with the chlorine content. No relation was found to exist between the acidity and the coagulability with rennet and with alcohol. The aldehyde reductase reaction was somewhat more rapid in low acid than in high acid milk.

Determination of adulterants in butter fat, G. SPITZER and W. F. EPPLE (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 828-831, fig. 1).—In this contribution from the Indiana Experiment Station a method for determining the adulteration of butterfat from the relation of the Reichert-Meissl and saponification numbers is proposed and discussed.

It is pointed out that, with the introduction of the processes of hydrogenation, the iodine number and refractive index are no longer of importance in determining adulteration, but that the Reichert-Meissl, saponification, and Polenske values are unchanged by hydrogenation. Assuming as constants representing average values for Reichert-Meissl and saponification numbers 28.5 and 228.5, respectively, for butterfat, 1.50 and 196 for oleo oils, and 7 and 259 for coconut oil, the authors have constructed a graph consisting of an equilateral triangle, the sides of which represent the three groups of fats. The base of the triangle is divided into 63 spaces representing saponification numbers from 196 to 259, and the right side of the triangle into 54 spaces each representing a Reichert-Meissl number of 0.5. On connecting the points representing the Reichert-Meissl and saponification numbers of the three groups of fats as noted above and drawing parallel lines through each division on both scales, the graph is completed. As thus drawn the right side of the triangle represents the oleo oil group, the left side butterfat, and the base the coconut oil group. After each side is divided into 20 equal spaces, each space corresponds to 5 per cent of the respective fats.

Analyses of mixtures of fats of known composition and comparison with the results obtained on the graph are reported, and indicate a percentage error of from 5 to 10 per cent.

[Aniline dye for coloring glymol] (*Michigan Sta. Rpt.* 1923, pp. 172, 173).—In experiments conducted by P. S. Lucas an oil-soluble aniline dye, Newport Oil Red 3 BS, has been found to give much more satisfactory results for coloring glymol than those obtained with alkanet root. Among the advantages claimed for this dye and a similar one, Newport Oil Red No. 13044, are that it is 500 per cent cheaper than alkanet root, is dissolved much more quickly, is not decolorized on exposure to air, and has no greater tendency to mix with the butterfat than the alkanet colored oil.

Sweetened condensed milk.—II, A comparative study of methods for determining total solids, R. C. FISHER and F. E. RICE (*Jour. Dairy Sci.*, 7 (1924), No. 5, pp. 497-502).—In this continuation of the studies previously

noted (E. S. R., 51, p. 380), 20 samples of milk were analyzed for total solids by the Official method, the Mojonnier method, and a modified test as follows: From 0.25 to 0.35 gm. of the thoroughly mixed sample was weighed into a tared aluminum dish, mixed with 2 cc. of hot distilled water, and evaporated on an electric hot plate at 180° C. until the first traces of brown appeared and then in an oven at the temperature of boiling water to a constant weight.

Taking the Official method as the standard, the average variation in percentage of solids was 0.47 for the modified and 0.57 for the Mojonnier method. The time required for the modified method was from 3 to 3½ hours as compared with from 5 to 6 hours for the Official method. The modified method is considered to be as reliable as the Mojonnier and is recommended on account of its simplicity and rapidity.

Surface tension of sugar factory products, K. R. LINDFORS (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 813-816).—Attention is called to the value of surface tension determinations in the control of sugar factory operations and in refinery processes. Data are reported illustrating the possibilities in this determination, with a few directions and precautions that must be taken in conducting the determination on sugar products.

The fermentation industries, R. FURNESS (*London: Ernest Benn, Ltd.*, 1924, pp. 19).—Included in this nontechnical discussion of fermentation industries are brief descriptions of the fermentation processes involved in the manufacture of beer, malt, alcoholic beverages, industrial alcohol, vinegar and lactic acid, glycerol from sugar, and acetone from starch.

METEOROLOGY

Why the weather? C. F. BROOKS ET AL. (*New York: Harcourt, Brace & Co.*, 1924, pp. XVI+310, pls. [25], figs. [3]).—This book is the outgrowth of notes on various kinds of weather phenomena, prepared for classes in meteorology and for the information of the general public. Though popular in form, care has been taken to insure accuracy. The information is grouped by seasons and a complete index is provided.

Monthly Weather Review, [July-August, 1924] (*U. S. Mo. Weather Rev.*, 52 (1924), Nos. 7, pp. 337-379, pls. 11, figs. 20; 8, pp. 381-419, pls. 15, figs. 13).—In addition to detailed summaries of meteorological and climatological data and weather conditions for July and August, 1924, seismological data for June, and notes, abstracts, and reviews, these numbers contain the following contributions:

No. 7.—The Distribution of Thunderstorms in the United States (illus.), by W. H. Alexander; Thunderstorms in Ohio during 1917 (illus.), by W. H. Alexander, C. F. Brooks, and G. H. Burnham; Severe Hailstorm at Rapid City, S. Dak., and Vicinity, July 18, 1924 (illus.), by H. N. Johnson; The Coefficient of Persistence, by T. A. Blair; Meteorology at the Toronto Meeting of the British Association for the Advancement of Science, August, 1924; and The Section on Meteorology of the International Geodetic and Geophysical Union, by B. M. Varney.

No. 8.—Substitution of Fruit Temperatures for Air Temperatures in Regulating Orchard Heating for Oranges (illus.), by F. D. Young (see p. 317); Oscillations of the Atmospheric Circulation over the North Atlantic Ocean in the 25-Year Period, 1881-1905 (illus.), by A. Defant, trans. by W. W. Reed, abs. by B. M. Varney; Tornado Near Fitchburg, Mass., July 17, 1924 (illus.), by C. F. Brooks; The Great Hailstorm in Southeastern New Hampshire and Northeastern Massachusetts, July 17, 1924 (illus.), by B. M. Varney; Wind-

storms in Wisconsin, August 7, 1924, by W. P. Stewart; and A Further Note on the Lorain, Ohio, Tornado of June 28 (illus.), by B. M. Varney.

Attention is called to the fact that at the close of the year ended June 30, 1924, it was decided to discontinue the publication of seismological reports in the *Monthly Weather Review*.

Climatological data for the United States by sections, [July–August, 1924] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 11 (1924), Nos. 7, pp. [191], pls. 4, figs. 2; 8, pp. [187], pls. 4, fig. 1*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for July and August, 1924.

Meteorological tables, D. A. SEELEY and B. B. WHITTIER (*Mich. State Bd. Agr., Ann. Rpt. Sec., 62 (1923), pp. 131–144*).—Daily and monthly summaries of temperature (maximum, minimum, and mean), precipitation, cloudiness, and sunshine, and monthly summaries of pressure (maximum, minimum, and mean), wind movement, and miscellaneous phenomena (frost, hail, thunderstorms, fog, auroras, and halos) at Lansing, Mich., are given for the year ended June 30, 1923.

Our climate, J. H. SPENCER (*Baltimore: Md. State Weather Serv., 1924, 2. ed., enl., pp. 47, figs. 28*).—This is a second and enlarged edition of a compendium of information regarding the climate between the Rocky Mountains and the Atlantic coast, with special reference to Maryland and Delaware, issued by the Maryland State Weather Service in cooperation with the U. S. Weather Bureau.

The outstanding climatic features of the two States are stated to be mild winters, warm summers tempered by cool spells, and pleasant springs and autumns. The average annual precipitation is 41.61 in. in Maryland and 43.25 in. in Delaware. The average annual snowfall for the region is about 27.5 in., which does not, as a rule, remain long on the ground. The number of days with some sunshine exceeds 300 annually. The frost-free period averages about 185 days. Prolonged droughts are rare.

A climatological history of Ohio, W. H. ALEXANDER (*Ohio State Univ. Engin. Expt. Sta. Bul. 26 (1923), pp. 745, figs. 136*).—This volume, published as a bulletin of the Engineering Experiment Station of Ohio State University as the first of a series bearing on the water resources of the State, is a compendium of historical, biographical, and statistical information regarding Ohio weather from the earliest settlement of the State to the present time.

"Part 1 contains a few very general observations of an introductory nature on the meteorological field in general, on the relation between meteorology and climatology, on the distinction between weather and climate, on the various efforts, official and otherwise, made to extend our knowledge of the atmosphere and to reduce that knowledge to a science of practical value, and briefly on the topography of the State. Part 2 is purely climatological [and portrays] by means of descriptive text, maps, charts, graphs, etc., the chief climatic features, as clearly revealed in the great mass of meteorological data now available. . . . Part 3 is almost wholly statistical . . . presenting the data by counties, alphabetically arranged."

Bioclimatic observations in the Egyptian desert in March, 1923, C. B. WILLIAMS (*Egypt Min. Agr., Tech. and Sci. Serv. Bul. 37 (1924), pp. [1] + 18, pls. 10*).—Observations for about a week in continuation of those of August, 1922, previously noted (*E. S. R.*, 49, p. 208) and in the same place in the Wadi Digla near Cairo, where no measurable rain had fallen since December, 1921, showed that "although the same temperatures and the same humidities occurred both in August and March, the same combination of temperature and

humidity never occurred in both months. Evaporation was nearly twice as great on the plateau as in the wadi."

In observations on the daily range of temperature in the sand, "the maximum surface temperature recorded was 43.6° C. and the minimum 6.5°. The variations decreased with depth and almost disappeared at a depth of 30 cm." Observations on temperature, vapor pressure, and relative humidity at different depths in caves indicated "that the relative humidity inside a deep cave varies with the changes in vapor pressure outside and not with the changes of relative humidity outside. As a result the relatively dry and wet seasons do not in the present case coincide inside and out but alternate, as outside the winter, although damper, has a lower vapor pressure than the summer."

Rain making, W. J. HUMPHREYS (*Abs. in Brit. Assoc. Adv. Sci. Rpt.*, 92 (1924), p. 368; *U. S. Mo. Weather Rev.*, 52 (1924), No. 7, p. 351).—This is the author's abstract of a paper presented before the recent meeting of the British Association for the Advancement of Science in which "several of the more persistently urged schemes for producing rain are considered in respect to the underlying principles involved, and measured quantitatively to determine the question of their practical use. These schemes include, especially, the production of loud noises, the use of chemicals, mechanical or forced convection, fog-collecting screens, dusting the sky, spraying liquid air onto clouds, and sprinkling clouds with electrified sand. None of these rain making methods is practicable in the commercial sense of the term, but each, when treated quantitatively, is full of meteorological interest."

Substitution of fruit temperatures for air temperatures in regulating orchard heating for oranges, F. D. YOUNG (*U. S. Mo. Weather Rev.*, 52 (1924), No. 8, pp. 381-387, pl. 1, figs. 7).—This is a report of preliminary observations on the freezing of oranges on the trees under natural conditions. It shows the wide variation of conditions under which freezing occurs and indicates the necessity of securing a much larger amount of data before final conclusions can be reached.

SOILS—FERTILIZERS

Report of the section of soils [at the Michigan Station], M. M. McCool ET AL. (*Michigan Sta. Rpt.* 1923, pp. 252-257).—A brief description is given of the work on soil fertility and on the physical and chemical properties of soils at the station, together with a short résumé of some of the progress findings.

G. J. Bouyoucos found in studies of soil aeration that the influence of barometric pressure is apparently great and is felt to a depth of several feet.

Investigations of the soil conditions which affect the root development of crops showed that the nature and extent of the root development of alfalfa are governed very largely by the nature of the soil profile.

Studies by Bouyoucos of the degree of change brought about in soils by igniting them at different temperatures, as indicated by heat of wetting, unfree water, and plasticity, showed that no appreciable change took place in these properties until a temperature of about 230° C. (446° F.) was reached. The changes increased in degree from this temperature up to a temperature of about 800°, at which the three physical properties were almost or completely destroyed. Different soils were also found to have markedly different physical reactions, which is attributed to the difference in activated surfaces of soils.

The toxicity, movement, and accumulation of nitrates and other salts occurring in arid soils, C. E. CRAIG (*New Mexico Sta. Bul.* 142 (1924), pp.

65).—Field and greenhouse studies of the toxicity, movement, and accumulation of nitrates and other salts in arid soils are reported.

The results showed that nitrates, either singly or in combination with varying amounts of mixed salts, were not unusually toxic to pop corn in water and sand cultures or in soils containing mixed salts. Under similar conditions nitrates were not toxic to field corn in plat tests. Nitrates in water and sand cultures were less toxic to pop corn than chlorides, and probably but slightly more toxic than the sulfates.

Magnesium salts were usually less toxic to pop corn than either sodium or calcium salts. The beneficial effects of magnesium sulfate were frequently noted in water, sand, and soil cultures. The different salts used in the sand cultures showed some differences in the reaction of the sand solution, some solutions being more alkaline than others. Salts were shown to be more toxic in hot weather than in cooler weather.

It was found that the toxic effect of excess salts may be largely overcome up to a certain point by the use of more water, but that when too large an amount of water is required there may be difficulty due to lack of soil aeration. No unusual accumulation of nitrates was observed either in plat tests in which different amounts of water were used both on fallow and cropped land or in sand cultures receiving graduated amounts of the various single salts occurring in soils.

Excessive leaching not only removed practically all of the nitrates from the soil but probably most of the soluble organic matter. The physical condition of the soil was injured, as indicated by the slower penetration of water toward the end of the season. The following year corn grown on the excessively leached plat responded to nitrates.

A great difference was shown in the effectiveness of leaching in very short distances. Most of the retained mineral salts were sulfates due to the relatively slow leaching of these salts, and to the relatively large amounts of sulfates in the irrigation water. Usually no large excess of nitrates was recovered from soils containing an excess of salts.

It is believed that the occurrence of nitrates even in excessive amounts may be usually largely accounted for by nitrification accompanied by capillarity. An examination of soil on which apple trees were dead or dying showed a small amount of nitrates but a large amount of other salts. Even the relatively large amounts of nitrates observed at the beginning of this study with trees probably were only a minor cause of the injury.

Nitrates moved more rapidly than other salts either in capillary or drainage water, followed in order by chlorides, sulfates, and soluble organic matter. The nitrates and chlorides were removed more completely by capillary water, but the sulfates and soluble organic matter were removed more completely in drainage than in capillary water. The greatest concentration of mineral salts in both capillary and drainage waters was found near the point to which the water had reached, but the soluble organic matter lagged behind the mineral salts.

Replaceable bases in soils, W. P. KELLEY and S. M. BROWN (*California Sta. Tech. Paper 15 (1924), pp. 39*).—Studies on the total content of the several bases present in replaceable form in normal soils of neutral or alkaline reaction, alkali soils, and acid soils are reported.

The total content of the several bases present in replaceable form was determined by taking advantage of the exchange reaction which takes place between soils and ammonium chloride. The exchange of bases proceeded to completion only when a sufficiently concentrated solution was used, which with ammonium chloride was approximately normal.

The replaceable bases of several neutral or slightly alkaline soils from California were composed mainly of calcium. Magnesium was present in the next highest amount, and there were only small amounts of potassium and sodium. Alkali soils were characterized by a relatively large amount of replaceable sodium and a correspondingly small amount of replaceable calcium. Several black alkali soils were studied which contained no replaceable calcium. The relation between the several replaceable bases of alkali soil depended upon the composition and concentration of the soluble salts. Where the soluble salts contained sufficient amounts of calcium compounds, the ratio of the replaceable bases could be similar to that of normal soils. It is concluded that replaceable sodium must be considered in the practical treatment of alkali soils.

The acid soils examined were characterized by a low total content of replaceable bases and by the presence in replaceable form of more or less trivalent bases, such as aluminum and iron. Acid soils had the power to absorb substantial amounts of calcium hydroxide, a part of which entered into replaceable form. The absorption of calcium hydroxide was not confined to acid soils, however, since a neutral soil was studied which absorbed large amounts of calcium hydroxide without an exchange of cations.

The greater part of the replaceable bases occurred in the clay fraction of soils, but different clays varied greatly in their total content. The hydrogen of carbonic acid could be substituted for a part of the replaceable bases. Dilute hydrochloric acid also displaced the bases but could attack other constituents as well. A neutral soil, which originally contained mere traces of trivalent bases in replaceable form, was found to contain substantial amounts after treatment with dilute hydrochloric acid. The replaceable bases are considered to be present not in a state of physical absorption but as chemical compounds, probably as complex alumino silicates which have been formed as a result of weathering.

Reaction of the soils of Germany and its significance [trans. title]. O. LEMMERMANN and L. FRESSENIUS (*Ztschr. Pflanzenernähr. u. Düngung*, 3 (1924) No. 6, *Wirtschaft.-Prakt.*, pp. 233-247).—A summary of data and other information is presented on the reaction of typical German soils, on the origin, nature, occurrence, and correction of soil acidity, and on the influence of soil acidity and its correction on crop yields.

The soil acid question [trans. title], DENSCH, HUNNIUS, and PFAFF (*Ztschr., Pflanzenernähr. u. Düngung*, 3 (1924), No. 6, *Wirtschaft.-Prakt.*, pp. 248-261).—A summary of the results of studies of different German soils is presented indicating that 25 per cent of all soils examined were distinctly acid. Soils on which crop growth was hindered and showed apparent acid injury either required lime or were nearing that stage.

The production of acid conditions in soils by the use of physiologically acid-reacting fertilizers was found to occur rarely, and then only under conditions of soil and weather which favored the concentration of acid in the surface soil.

Injury due to lime deficiency, with the resulting production of unfavorable physical and biological as well as chemical conditions in the soil, is considered to be more important than the actual presence of acid.

Acidity and soil organic matter [trans. title], V. VINCENT (*Ann Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 4, pp. 260-271).—Studies of the action of different lime compounds on peat and other organic matter are reported.

The results are taken to indicate that the acidity of peat formed in granitic soils is due to acid organic matter, and that the capacity of peat for combining with lime is due to the presence of acid and neutral organic matter and

to silica deposited in the tissues of decomposed plants. Further experiments showed that lime fixed by peat in organic combination can be partially removed by carbonic acid.

The practical application of these results in the study of soils and soil acidity is discussed briefly.

The cycle of carbon dioxide in nature, H. LUNDEGÅRDH (*Der Kreislauf der Kohlensäure in der Natur*. Jena: Gustav Fischer, 1924, pp. VIII+308, figs. 47).—This is a contribution to plant ecology and the technique of fertilization as influenced by carbon dioxide in soil, plant, and atmosphere. It contains chapters on the sources and content of carbon dioxide in the atmosphere; the dependence of the intensity of assimilation on the concentration of carbon dioxide and other conditions; carbon dioxide as a growth factor; carbon dioxide production by soil; carbon dioxide concentration at the level of the organs of assimilation and its dependence upon soil respiration, assimilation, and air movement; and the ecological and agricultural importance of the carbon dioxide factor.

Presence of Azotobacter in Polish soils [trans. title], J. ZIEMIĘCKA (*Rocz. Nauk Rolnicz.*, 10 (1923), No. 2, pp. 233-310).—Studies are reported on the presence, nature, and activities of Azotobacter in samples of soil from 13 different Polish experiment stations.

Of 28 soils examined, half showed the presence of Azotobacter. Azotobacter were rarely present in soils containing less than 5 per cent of moisture and were much more abundant in soils containing from 20 to 26 per cent of moisture. They were also almost totally absent from soils with an acid or neutral reaction but were abundant in slightly alkaline soils, and especially so in soils well supplied with calcium carbonate. A humus content of around 1.5 per cent favored the presence of Azotobacter. Apparently reaction and humus content were the main factors governing the growth of Azotobacter in soils.

Soil type and season were factors influencing nitrogen fixation in soil by Azotobacter in addition to the factors noted above. Nitrogen fixation increased regularly with the moisture content. Fixation was more intense in the fall than in the spring, and was favored by an alkaline reaction and the presence of calcium carbonate, calcium oxide, humus, and an excess of phosphoric acid.

Most of the soils containing Azotobacter produced an intense development of these organisms in nutritive solutions, which increased with the alkalinity of the soil and was accompanied by an increased nitrogen fixation. The number of Azotobacter in a soil apparently had no influence on their development in nutritive solutions or on nitrogen fixation. Also, the kind of nutritive solution used markedly influenced their growth and activities, additions of so-called sodium humate apparently favoring both. Other soil organisms were found to prosper in nutritive solutions favorable to Azotobacter. These included so-called granulobacter, cocci, bacilli, yeasts, molds, and protozoa.

Influence of bacteria on the solution of phosphates in soil [trans. title], J. STOKLASA and P. KŘIČKA (*Centbl. Bakt. [etc.]*, 2. Abt., 61 (1924), No. 11-18, pp. 298-311, fig. 1).—Continuing work previously noted (E. S. R., 25, p. 624), studies on the relation between the solubility of artificially prepared and natural phosphates and bacterial activities in soils are reported.

Ventilation with air containing radium emanations favored the growth of Azotobacter and the absorption of phosphate ions by these organisms. The greatest assimilation of elementary nitrogen by Azotobacter took place in the presence of disodium phosphate. The absorption of phosphoric acid from mineral phosphates was considerably increased. This process was found to depend upon the fluorine content of the phosphate.

The separation of the fluoride and carbonate from neutral phosphates resulted in a complete change in the composition of the phosphate mass. The absorption of the phosphoric acid by the root systems of plants was more energetic when the phosphate contained very little fluorine.

Vegetation studies showed that the carbon dioxide and organic acids of soils are not so active in the solution of fluorides in neutral phosphates as are the sulfates. It is concluded that the transformation of the insoluble phosphoric acid of soil into a form available to plant roots by the use of ammonium sulfate or ammonium nitrate is due to the addition of nitrogen as well as to the release of sulfate and nitrate ions.

Methods of preventing injury.—III, **Soil disinfection** [trans. title], E. Voet (*Centbl. Bakt. [etc.], 2. Abt., 61 (1924), No. 11-18, pp. 323-356*).—An extensive discussion of the object, results, and methods of partial sterilization of soils by means of organic and inorganic chemicals is presented.

Partial sterilization of soil [trans. title], G. RIVIÈRE and G. PICHARD (*Ann. Sci. Agron. Franç. et Etrang., 41 (1924), No. 4, pp. 251-253*).—In continuation of work previously noted (E. S. R., 47, p. 120), studies on the partial sterilization of different soils are briefly reported.

The results showed that the sulfites of calcium and magnesium act on the bacterial flora and fauna of soil at first as antiseptics. However, when used at the rates of from 4.6 to 12 gm. per square meter the protozoa are destroyed, and the useful bacteria revive and multiply in greatly increased numbers.

Soil survey of Sussex County, Delaware, J. M. SNYDER ET AL. (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. III+1531-1565, pl. 1, fig. 1, map 1).—This survey, made in cooperation with the Delaware Experiment Station, deals with the soils of an area of 604,800 acres lying in the Coastal Plain region in southern Delaware. Three physiographic divisions are developed, including the uplands in the northern and west-central parts of the county, the low poorly drained land in the southeastern and northeastern parts, and the marshes along the bay and ocean.

The soil materials were originally accumulated as marine deposits. Including tidal marsh, swamp, coastal beach, and meadow, 20 soil types of 7 series are mapped, of which the Sassafras sandy loam, Elkton sandy loam, and Sassafras loamy sand cover 19.6, 15.2, and 10.4 per cent of the area, respectively.

Soil survey of Screven County, Georgia, D. D. LONG ET AL. (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. IV+1623-1657, fig. 1, map 1).—This survey, made in cooperation with the Georgia State College of Agriculture, deals with the soils of an area of 416,000 acres lying in the Coastal Plain region in eastern Georgia. The several different topographic forms found in the county include flatwoods, undulating plains, rolling uplands, alluvial terraces, and flat swampy areas. The drainage of the county is said to be generally well established.

The soils are mainly light in color, are practically neutral or slightly acid in character, and are derived chiefly from unconsolidated Coastal Plain deposits. Including swamp and peaty muck, 28 soil types of 16 series are mapped, of which Norfolk sandy loam, swamp, and Norfolk sand cover 27.2, 17.7, and 15 per cent of the area, respectively.

Soil survey of Greene County, Iowa, A. W. GOKE and C. L. ORRBEN (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+281-303, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 367,360 acres lying in the Wisconsin drift area in central Iowa. It is included in the upper Mississippi plains region.

The area is said to have the drift plain topography characteristic of this part of the State. The Raccoon River traverses the county from northwest to southeast and provides adequate drainage for about half. The rest of the county has very little natural drainage, and ponds and poorly drained tracts are numerous.

The soils of the county are differentiated into dark colored and light colored soils. Including peat and muck, 21 soil types of 12 series are mapped, of which the Carrington loam and Webster silty clay loam cover 53.5 and 26.2 per cent of the area, respectively.

Soil survey of Caldwell County, Missouri, W. DE YOUNG and H. V. JORDAN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+323-348, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 277,120 acres situated in the rolling prairie region of northwestern Missouri. Approximately two-thirds of the county was originally prairie land.

The soils of the county have been derived from loessial and glacial material, and to a smaller extent from the underlying shale and limestone formations. The individual soil types, however, owe their present characteristics more to the stage of weathering that has been reached than to the character of the parent material. The upland soils are divided into two general groups, the smooth to undulating prairie soils and the rolling forested soils. Fourteen soil types of 9 series are mapped, of which the Grundy and Wabash silt loams, the Shelby loam, and the Summit and Pettis silt loams cover 30.8, 16.3, 15.9, 10.9, and 10.4 per cent of the area, respectively.

Soil survey of Tompkins County, New York, F. B. HOWE ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1920, pp. IV+1567-1622, pls. 3, fig. 1, map 1*).—This survey, made in cooperation with the New York State College of Agriculture, deals with the soils of an area of 304,640 acres lying entirely within the Allegheny Plateau near the central part of New York. The northern part of the county is gently rolling, while the southern part is a roughly dissected hilly plateau. Drainage is said to be moderately well to well established.

The soils of the county are derived from glacial materials, and range in texture from fine sandy loam to a heavy silty clay loam with the prevailing texture a silt loam. Including rough stony and broken land and meadow, 30 soil types of 16 series are mapped, of which the Lordstown stony silt loam, Canfield silt loam, and Wooster gravelly silt loam cover 17.8, 16.9, and 11.1 per cent of the area, respectively.

Crop yields on soil experiment fields in Iowa, W. H. STEVENSON, P. E. BROWN, L. W. FORMAN, ET AL. (*Iowa Sta. Bul. 221 (1924), pp. 73-104, figs. 2*).—Considerable data from the soil experiment fields in Iowa are summarized in this report, and a list of suggestions to farmers as to the management of Iowa soils is presented.

The management of several types of western Washington soils, M. E. MCCOLLAM (*Western Washington Sta. Bimo. Bul., 12 (1924), No. 4, pp. 78-82*).—In a revision of a previous statement on the subject (*E. S. R., 46, p. 215*), practical information is presented on the management of gravelly sandy loam, silt loam, and muck and peat soils occurring in western Washington.

Long time fertilizer experiments at the Lauchstädt and Gross Lübars Experiment Stations [trans. title], W. SCHNEIDEWIND (*Ztschr. Pflanzenernähr. u. Düngung, 3 (1924), No. 8, Wirtschaft.-Prakt., pp. 313-325*).—The results of two sets of fertilizer experiments, one begun in 1903 and the other in 1908, are briefly summarized, special attention being drawn to the influence of the use of stable manure with commercial fertilizers.

For instance, the yields of grain and root crops did not decrease where complete fertilization with stable manure and commercial fertilizers was practiced. However, in the absence of either form of fertilizer the yields decreased, the decrease being greater on plats receiving no stable manure. It is further shown that soils receiving large quantities of stable manure over a period of four years need very little potash, while where no stable manure is used there is a need for potash fertilization even on soils well supplied.

Action of stable manure in the decomposition of cellulose in tilled soil, C. BARTHEL and N. BENGTSSON (*Soil Sci.*, 18 (1924), No. 3, pp. 185-200, fig. 1).—Studies conducted at the Central Agricultural Experiment Station, Stockholm, are reported. In this work the method for the determination of cellulose in soil originated by Charpentier was so modified and perfected as to make possible the determination of the power of the organisms present in various soils to decompose cellulose and the influence of various factors on this process.

The favorable influence of stable manure upon cellulose fermentation in soil was found to be due to the nitrogen present in the manure which is available to microorganisms. Microorganisms added with the manure were of no practical importance in normal soils, since sterilized manure acted in the same manner as unsterilized manure. The ammonia nitrogen in the manure could be displaced by other ammonia compounds with the same result. The cellulose fermentation in autoclaved soil, inoculated either with manure or unsterilized soil, proceeded much more rapidly than in unsterilized soil because of the ammonia nitrogen split off from higher nitrogen compounds during sterilization.

Nitrogen survey.—Part IV, The nitrogen situation in European countries, H. A. CURTIS and F. A. ERNST (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul.* 270 (1924), pp. II+49).—In a fourth contribution to the subject (*E. S. R.*, 51, p. 726), a brief sketch is given of the principal features of the nitrogen situation in a number of European countries.

Action of nitrogen and phosphoric acid on Silesian soils in 1923 [trans. title], D. MEYER, F. MEISZNER, and K. WODARZ (*Ztschr. Pflanzenernähr. u. Düngung*, 3 (1924), No. 9, *Wirtschaft.-Prakt.*, pp. 353-378).—A summary is presented of the results of 18 field experiments with grain, potatoes, and beets to determine the fertilizing influence of nitrogenous and phosphatic fertilizers.

Comparative tests of phosphatic fertilizers [trans. title], E. ROUSSEAU (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 4, pp. 241-250).—A comparison of a phosphatic paste made of phosphate rock pulverized to colloidal fineness with superphosphate and phosphatic slag on rye and potatoes in different soils showed that the colloidal phosphate was considerably inferior to the other two fertilizers.

Weathering of granite [trans. title], E. BLANCK and H. PETERSEN (*Jour. Landw.*, 71 (1924), No. 3-4, pp. 181-209).—A very technical discussion of the subject is given, particular reference being made to the influence of weathered silicates on the character of soil types.

Residual effects of forty years' continuous manurial treatments.—I, **Effect of lime on decomposition of soil organic matter**, J. W. WHITE and F. J. HOLBEN (*Soil Sci.*, 18 (1924), No. 3, pp. 201-217, figs. 4).—In a contribution from the Pennsylvania State College a summary is given of data from three differently treated soils at the end of 40 years of continuous cropping,

during which time 40,000 lbs. of burnt lime were applied in one series in comparison with 80,000 lbs. of pulverized limestone.

The data are taken to indicate conclusively that there was no significant difference in the action of burnt lime and limestone on soil organic matter, even though for 40 years the two forms of lime were applied in amounts eight times that now recommended for soils of limestone origin. Both the limestone and burnt lime treated soils showed a significant increase of nitrogen over that found in the untreated soil. There is considered to be no evidence whatsoever to warrant the belief that burnt or caustic lime has a destructive action on soil organic matter in excess of such action by calcium carbonate. On the contrary, both forms of lime conserve nitrogen and organic matter as compared with the untreated soil.

The effect on present soil reaction of long-continued applications of equivalent amounts of high-calcium and high-magnesium limes, P. S. BURGESS (*Soil Sci.*, 18 (1924), No. 3, pp. 169-172).—Studies conducted at the Rhode Island Experiment Station are briefly reported, the results of which are taken to indicate that measurable differences in the ability to neutralize soil acidity are shown between the hydrates and carbonates of high calcium and high magnesium limes when applied to field soils in chemically equivalent quantities over long periods of time, and that such differences, to a slight extent, are reflected in crop yields.

Use of molasses as fertilizer [trans. title], L. FAUQUE (*Rev. Agr. Maurice*, No. 4 (1922), pp. 179-182).—Laboratory experiments of short duration are briefly reported which showed that the addition of molasses to plain soil and to soil treated with lime retarded nitrification. This action persisted until an excess of lime was added and the soil aerated.

Use of molasses as fertilizer on the Island of Mauritius [trans. title], P. de SORNAY (*Rev. Agr. Maurice*, No. 5 (1922), pp. 229-240).—Experiments on the influence of molasses on soil and vegetation on the island are briefly reported.

It was found that soils treated with molasses do not contain on the average any more nitrogen than soils not so treated. No very strong evidence was obtained that the sugar and glucose contents of molasses are more than indirectly beneficial, due to their influence in increasing biological fermentation in soil. Data are presented indicating that the composition of molasses varies considerably for different varieties of cane.

The good results obtained with crops on some soils are apparently due to the content of nutritive constituents and organic matter in the molasses, rather than to any special influence on the biological activities of the soil.

The computation of fertilizer mixtures from concentrated materials, A. R. MERZ and W. H. ROSS (*U. S. Dept. Agr. Bul.* 1280 (1924), pp. 16, pls. 4).—Data and an analytical discussion on the computation of fertilizer mixtures from concentrated materials are presented. These deal with the triangular system for fertilizer mixtures, factors that influence the concentration of fertilizers, concentrated fertilizer compounds, and standard fertilizer mixtures for concentrated materials.

It is stated that the materials now used in the fertilizer industry contain, as a rule, only one of the three plant nutrients. Consequently the calculation of the quantities of these materials required for a mixed fertilizer of given analysis formula is a comparatively easy arithmetical process. As the number of materials, particularly those of a single constituent, is reduced, the range of fertilizer analysis formulas which they are capable of making is also reduced, and the difficulty of the ordinary arithmetical method of calculating any mixture may be greatly increased. It is pointed out that the number of

materials used in mixed fertilizers is likely to decrease, and that the concentration of those used will probably increase.

Tables are presented giving the results of computations for the 52 analysis formulas adopted by conferences of agronomists and fertilizer manufacturers as standards for the 24 States represented.

AGRICULTURAL BOTANY

[**Work in plant physiology at the Michigan Station**], R. P. HIBBARD (*Michigan Sta. Rpt. 1923 pp. 211, 212*).—In a previous publication (E. S. R., 51, p. 124) the author expressed the opinion that different salt solutions were needed for the maximum growth of wheat under different climatic conditions. Subsequent laboratory and greenhouse studies with Marquis wheat did not confirm this conclusion, but they showed that there is probably a best culture for all climatic conditions and that there are other limiting factors that have not yet been determined.

The results of his studies during the period reported upon are said to indicate that from 40 to 50 plants should be used for each culture, that the solution should be changed frequently to get the best results, and that pure line seed, or seed from a single plant selection give more uniform seedlings. Special methods of germination were devised, and by following all the above methods more uniform results were obtained.

Investigations on the nitrogenous metabolism of the higher plants.—Part II, The distribution of nitrogen in the leaves of the runner bean, A. C. CHIBNALL (*Biochem. Jour.*, 16 (1922), No. 3, pp. 344-362, fig. 1).—In the first part of this series (E. S. R., 47, p. 109) a method of isolating part of the protein complex of fresh leaves was described. Using this method and the leaves of the runner bean, a method has been evolved whereby the whole of the nitrogenous material in the leaf is obtained in a state suitable for subsequent analysis. The method and its application to the results are set forth in tabular and graphical detail, with discussion.

Three main series of experiments have been carried out to determine seasonal variations, diurnal variations, and the results of starvation. As regards seasonal variations, total N and protein N, calculated as percentages of fresh weight, vary with growth, decreasing when this is very rapid or when pods are forming. The distribution of N in the colloidal protein remains practically unchanged throughout the series. Asparagin N and free ammonia N remain low throughout the series. Nitric N and monamino N vary directly with the protein N, indicating that they may be connected with protein synthesis. Similarly the other N varies inversely as the protein N, indicating that it may be connected with protein degradation. The water-soluble products show considerable variation throughout the series, indicating that comparison of leaves from plants of different age is impossible.

As regards diurnal variations, the diminution of total solids at night is accompanied by a diminution of total N and protein N. A distinct rise in the nitric N occurs at night while asparagin N disappears, other water-soluble products remaining more or less unchanged during the night. The most significant diminution of nitrogenous products at night must be assigned to the proteins, indicating translocation of unchanged protein or of its decomposition products.

The starvation experiments show that there is a considerable decrease of protein N, with increase of water-soluble N. The distribution of N in the colloidal protein and the amount of nitric N and ammonia N remain unaltered. More exclusively chemical data and inferences therefrom are detailed.

Diurnal variations in the total nitrogen content of foliage leaves, A. C. CHIBNALL (*Ann. Bot. [London]*, 37 (1923), No. 147, pp. 511-518).—In further comparing the day and night samples of leaves, and using the percentage of the fresh leaf weight as a basis, the results, given in tabular form with discussion, supposedly establish the fact that in general there is a withdrawal of nitrogen from the leaves at night. It is also claimed to have been shown that at least for trees the amount decreases as the leaf ages.

Influence of ammonium sulphate on plant growth in nutrient solutions and its effect on hydrogen-ion concentration and iron availability, L. H. JONES and J. W. SHIVE (*Ann. Bot. [London]*, 37 (1923), No. 147, pp. 355-377, figs. 6).—The data reported in this paper are the main results of an investigation of the use of ammonium sulfate in a complete nutrient solution as a source of nitrogen for soy beans during the early stages of growth. A previous study (*E. S. R.*, 45, p. 733) with wheat along similar lines has been carried out, though not so completely.

The plants grown in the Tottingham solutions invariably produced a marked decrease in the H-ion concentration of the solutions. The plants grown in the solutions containing ammonium sulfate invariably increased the H-ion concentrations of these solutions during the early stages of growth, the H-ion concentrations of these solutions being maintained at a much higher level than those of the unmodified Tottingham solutions, although the initial pH values of corresponding solutions of the two types were practically the same. "The nature of the salt constituents determines the direction of the reaction change of the culture solutions in contact with the roots of the growing soy bean plants.

"Ferric phosphate in quantities of less than 1 mg. of iron per liter of nutrient solution was not sufficiently available in the Tottingham solutions to supply the needs of the plants for iron during the early stages of growth. . . . Ferrous sulfate in quantities of from 0.25 to 0.5 mg. of iron per liter of nutrient solution was sufficiently available in the Tottingham solutions to satisfy the needs of the plants for iron. However, ferrous sulfate in the solution containing ammonium sulfate produces a condition very toxic to the plants, the degree of toxicity increasing with increase in the amounts of iron from 0.25 to 5 mg. per liter of nutrient solution.

"Ferrous sulfate when used in too high concentrations produces on the leaves of soy bean plants in both series a characteristic brown specking which is more pronounced in the solutions containing ammonium sulfate than in the unmodified Tottingham solutions. The availability for the plants of a given iron compound and its efficiency appear to be determined in large measure by the composition of the nutrient solution and by the nature of the reaction change induced by contact with the plant roots.

"With the solutions containing the salts KNO_3 , KH_2PO_4 , $\text{Ca}(\text{NO}_3)_2$, and MgSO_4 (Tottingham solutions), the maximum yield of soy bean tops was obtained when these salts were present in the volume-molecular proportions 0.002, 0.00211, 0.0073, and 0.00711, respectively, with ferrous sulfate as the source of iron. The maximum yield of roots was obtained with a solution containing these salts in the volume-molecular proportions 0.002, 0.00633, 0.00438, and 0.00711, respectively, with ferrous sulfate as the source of iron. Good yields of tops and roots were obtained with only a narrow range in the proportions of potassium nitrate, but with relatively wide ranges in the proportions of the other salts.

"With the solutions containing $(\text{NH}_4)_2\text{SO}_4$, KH_2PO_4 , $\text{Ca}(\text{NO}_3)_2$, and MgSO_4 , the maximum yield of both tops and roots was obtained when these salts were present in the volume-molecular proportions 0.0014, 0.00211, 0.00146, and

0.01659, respectively, with ferric phosphate as the source of iron. Good yields of tops and roots were obtained with only the lowest proportions of ammonium sulfate but with relatively wide ranges in the proportions of the other salts. In general, high yields of tops were associated with high yields of roots."

Carbon dioxide in relation to glasshouse crops.—Part I, The distribution of carbon dioxide in glasshouse atmospheres, O. OWEN (*Ann. Appl. Biol.*, 10 (1923), No. 3-4, pp. 312-317, figs. 2).—"In spite of the objections which have been noted to methods of sampling, it is maintained that if the suggested atmospheric stratification does exist in glasshouses it would have been manifested in at least some of the many series of observations carried out in this work. It is concluded, therefore, that such stratification does not exist."

Carbon dioxide in relation to glasshouse crops.—Part II, The preparation of an atmosphere rich in carbon dioxide, O. OWEN and P. H. WILLIAMS (*Ann. Appl. Biol.*, 10 (1923), No. 3-4, pp. 318-325, figs. 3).—In the investigations here reported an attempt was made to evolve a method of obtaining a given carbon dioxide concentration which would persist, preliminary experiments in a normal cucumber house having shown that the carbon dioxide disappears as soon as it is put in, part of this doubtless being taken up by the plants, but probably the greater part being diffused through the ventilators, glass overlaps, and door, and through soil absorption. To eliminate these factors in this work the soil was covered with concrete, the overlaps were filled with putty, and the door and all the ventilators of a small chamber were well padded. The results obtained under these conditions form the greater part of the present communication.

"Contrary to general belief it is shown that the gas is not distributed in layers. The concentration has been in certain cases artificially increased, but even then no evidence of stratification is found. It is also shown that the average maximum concentration in the presence of cucumber plants occurs between 4 a. m. and 7 a. m. and the minimum between noon and 3 p. m.

"A method is described whereby atmospheres containing up to 200 parts per 10,000 of air can be prepared. The gas is prepared from sulfuric acid and sodium bicarbonate, and, providing an initial mixing takes place, it is uniformly distributed. It is shown that the distribution is independent of the total amount of carbon dioxide present, the presence of soil, and the presence of plants. A definite loss of carbon dioxide always occurs, and a curve showing the rate of fall has been obtained."

The chlorid content of the leaf tissue fluids of Egyptian and upland cotton, J. A. HARRIS and J. V. and Z. W. LAWRENCE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 695-704).—In a previous paper (E. S. R., 51, p. 331) it was shown that some of the physicochemical properties of Pima Egyptian and Acala and Meade upland cotton varied quite appreciably. In the present paper the authors present the results of a detailed comparison of the chloride content of the leaf tissue fluids of Egyptian and upland cotton. It was found that almost without exception the chloride content was higher in the tissue fluids of the Egyptian than in the upland cotton, and this is believed to indicate a greater capacity of the Egyptian type for growth on saline soils.

The effect on certain plants of altering the daily period of light, J. ADAMS (*Ann. Bot.* [London], 37 (1923), No. 145, pp. 75-94).—In order to throw more light on the problem regarding the effect of light on plant development (E. S. R., 44, p. 728), the author experimented in the greenhouse during June and July, 1920, and for the most part in open ground in June and July, 1921.

In these experiments, which employed wheat, maize, liverwort, white mustard, soy bean, wax bean, flax, *Tiarella cordifolia*, tomato, sunflower, and dandelion, it was found in almost all cases that the longest exposure to light gave the greatest average weight, greatest average height, and earliest flowers. The conclusion is drawn that growth or extension in length can take place both in light and in darkness, and that in both cases the amount of growth within a definite period of time is determined largely by the supply of available reserve material and the readiness with which this can be drawn upon by the growing parts.

The replacement of the terminal bud in the coco-nut palm, T. PETCH and C. H. GADD (*Ann. Bot. [London]*, 37 (1923), No. 147, pp. 445-450, figs. 3).—In the contribution by Sharples and Lambourne (*E. S. R.*, 48, p. 849) cases are described in which it appeared that the terminal bud had been destroyed and that growth had subsequently occurred from a lateral bud. The object of the present note is to record a similar occurrence in Ceylon in which the origin of the apparently lateral growth was traced by dissection of the plant. In March, 1922, two specimens of diseased seedling coconut palms from the Galle district were examined, and the findings are briefly detailed herein. It is concluded that before abandoning the prevailing idea as a fallacy further evidence must be adduced, in view of the Ceylon examples, to show that, in the condition caused by artificial inoculations, the bud is truly a lateral and not the further growth of the original terminal after a temporary arrest caused by the invading organisms.

Correlation between loss of leaf and damage to crop in late attacks on wheat, A. ROEBUCK and P. S. BROWN (*Ann. Appl. Biol.*, 10 (1923), No. 3-4, pp. 326-334, figs. 6).—This experiment was undertaken to find the basis for estimating the effects on wheat yield associated with percentages of loss of leaf surface in the case of the varieties Little Joss and New Red. The degrees of leaf deprivation employed involved loss of all blades, loss of half of each blade, and loss of all leaves from the bottom half of the stalk. Results are tabulated and discussed.

The losses due to reduction of leaf surface were largest when the plants were taken young, decreasing as older plants were taken. Apparently the lower leaves play a considerable part in grain formation. Both numerical and graphical showings emphasize the regularity of crop depression due to loss of leaf surface. An attack of *Agromyza ambigua* on Marshal Foch wheat caused also a slight depression (0.37 per cent) of grain yield, decreasing leaf surface 2 per cent.

Indicator significance of the natural vegetation of the southwestern desert region, H. L. SHANTZ and R. L. PIEMEISEL (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 8, pp. 721-802, pls. 14, figs. 21).—The results are given of studies made during the period 1914-1917 of the natural vegetation of southwestern Arizona, southern Nevada, and southeastern California, the Coachella Valley, Calif., and the Gila Valley in Arizona being investigated in detail, and less extensive studies having been made elsewhere. The vegetation was found to be correlated with soils, temperature, rainfall, etc., and the agricultural value of the different types of soils, as indicated by their plants, is pointed out.

GENETICS

Chromosomes in maize and maize relatives, A. E. LONGLEY (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 7, pp. 673-682, pls. 3).—The chromosome numbers in several genera of the tribe Tripsaceae were studied in connection with genetic investigations of *Zea mays* and its relatives.

Pairing promptly at diakinesis of the pollen mother cell, the chromosomes of *Euchlaena perennis* give 20 bivalents; *Z. mays*, strains Tepic and Chinese waxy, 10 bivalents; *Z. mays* \times *E. mexicana*, 10 bivalents; *Coix lachryma jobi*, 10 bivalents; and *Tripsacum dactyloides* approximately 35 bivalents. The chromosome number of *E. mexicana* at diakinesis of normal-appearing pollen mother cells is 10 bivalents, although occasionally 11 or 12 chromosomes have been found in reduction phases appearing abnormal. The chromosomes of *Z. mays* \times *E. perennis* combine at diakinesis of the pollen mother cell into trivalent or bivalent chromosomes or remain uncombined as univalents. The number of chromosome elements is 30, the sum of the haploid number of the two parents. Although in *T. laxum*, *T. pilosum*, and *T. lanceolatum* the presence of both univalent and bivalent chromosomes at diakinesis makes difficult the assigning of a definite haploid chromosome number, this is said to approximate 35.

A rare carbohydrate in waxy maize, P. WEATHERWAX (*Genetics*, 7 (1922), No. 6, pp. 568-572).—In the corn variety previously noted (E. S. R., 44, p. 230) the sole carbohydrate is the rare erythrodextrin, a dextrin which is turned red by iodine. Besides possessing certain vegetative peculiarities, this variety has an endosperm distinctly different from that of other varieties, justifying its recognition as a cultural variety coordinate with flint, dent, and pop corn.

"Waxy maize has doubtless arisen from starchy maize by mutation, and the nature of its endosperm indicates that its origin has been as simple as that of sweet corn, since only the size of the molecule of reserve material has been affected. Inasmuch as the sporadic appearance of sweet corn as a mutant from starchy corn in many parts of America is known, the occurrence of waxy maize in China and in Upper Burma is probably of no great significance as an indication of the pre-Columbian occurrence of maize in Asia."

On the distribution of mutant characters among the chromosomes of *Oenothera lamarckiana*, H. DE VRIES and K. BOEDIJN (*Genetics*, 8 (1923), No. 3, pp. 233-238, fig. 1).—During the last 10 years the number of distinct mutant types of *O. lamarckiana* has increased considerably, and one of the authors has determined the chromosome numbers for most of these, including those older ones for which these figures had not previously been ascertained. Moreover, the fact that some mutant types are repeatedly produced by others has become very prominent, indicating, supposedly, some kind of genetic relationship. Outward features are often observed to run parallel with such connections; in other cases they are so much alike as to give another trustworthy basis for the assumption of closer relations.

Starting from these facts, the authors have tried to arrange the mutant types into distinct groups, analogous to those proposed for *Drosophila*. They start from the numbers of the chromosomes, and bring those mutants which do not deviate in this respect from the main species into the first group. In doing this it is found that almost all of them belong to the ordinary types of mutations. They are mostly due to recessive characters, as, for instance, the dwarfs and the brittle races.

"In a large number of the other mutants one of the chromosomes is doubled, bringing the total number of these bodies up from seven to eight in the haploid cells, and from 14 to 15 in the somatic nuclei. Here, however, it is clear that the relations are not so intimate as to allow the combining of all these forms into one single group. Evidently there are some main mutations, from which the others may be derived, or to which they can be subordinated. These primary mutations have been described . . . under the name of dimorphic mutants (de Vries 1916 [E. S. R., 37, p. 131]), since, after self-fertilization, their progeny mainly consists for one part of individuals of the

parental type, and for the remainder, of specimens of the type of the original species, *O. lamarckiana*. All of them are heterogamous, since their characters are not reproduced by means of their pollen. Of these dimorphic mutants there are six main types." These have been described, and are here discussed.

A scheme is presented which is, admittedly, only provisional and in part arbitrary, though corroborated by the analogous results of experiments cited with *Datura*, and with *O. lamarckiana*.

An attempt to improve through selection the style length and fertility of *Oenothera brevistylis* B. M. DAVIS (*Genetics*, 7 (1922), No. 6, pp. 590-596).—In a paper previously noted (E. S. R., 41, p. 431) the results were given from a selfed line of *O. brevistylis* which had been carried for two generations through plants selected for greater variation in the direction of normal styles and stigmas. This line after passing through five generations of selection has shown no improvement, but in later years a retrogression so positive as to give no encouragement to further trial.

Apparently the variations in style length and fertility of *O. brevistylis* are not due to heritable factors, and consequently there can be no permanent success in selection for the improvement of these characters. The author inclines to the view that the factors which are responsible for the reduced style length and stigma structure in this plant, and with the correlated very low fertility, are fixed, in the sense that they express themselves through fluctuations within distinctly limited ranges. The lower ranges are close to the usual conditions in the plant, which are those of complete or almost complete sterility. The higher ranges may be found by close observations on performance and tests for fertility. They express a small but definite advance in style length and stigma structure and in somewhat increased fertility, but there is no evidence that such improvement will be inherited.

A reversionary character in the stock (*Matthiola incana*) and its significance in regard to the structure and evolution of the gynoeceum in the Rhoeadales, the Orchidaceae, and other families, E. R. SAUNDERS (*Ann. Bot. [London]*, 37 (1923), No. 147, pp. 451-482, figs. 62).—Regarding general features discussed, it is stated that evolution in the Rhoeadales has been accompanied by reduction and consolidation of the members of the gynoeceum, leading to the production of two kinds of carpels, the hollow or valve type and the solid type. The morphological transformation from the valve to the solid type has been accompanied by redistribution of the carpellary functions. The conclusions are detailed concerning the Papaveraceae and Fumariaceae, the Cruciferae, the Capparidaceae, and the Resedaceae. It is proposed to treat the other families here cited and certain isolated genera in a later communication.

Interspecific hybrids in *Crepis*.—II, A preliminary report on the results of hybridizing *Crepis setosa* Hall. with *C. capillaris* (L.) Wallr. and with *C. biennis* L., J. L. COLLINS and M. C. MANN (*Genetics*, 8 (1923), No. 3, pp. 212-232, figs. 9).—In the first paper of this series (E. S. R., 46, p. 721) the F_1 hybrid of *C. capillaris* \times *C. tectorum* was described in detail. It was pointed out that the compatibility between these two species was so low that the two haploid sets of chromosomes were unable to function together, with the result that the F_1 plants were unable to grow beyond the seedling stage. The present paper presents preliminary data on two other species hybrids, obtained by crossing *C. setosa* with *C. capillaris* and with *C. biennis*, both of which are able to complete growth to maturity. The material and methods are described, and the results are given in some detail.

"When the chromosomes are irregularly distributed, as in the meiosis of the F_1 from *C. setosa* \times *C. capillaris*, a means is afforded whereby chromosome

number may, by subsequent breeding, be increased by one or a few pairs. Thus, breaks in chromosome number series, such as we find in the genus *Crepis*, may be caused by hybridization, not necessarily by nondisjunction. . . .

"The back crosses from the F_1 (*C. setosa* \times *C. capillaris*) \times *C. setosa* indicate that the germ cells of the F_1 have a greater probability of survival if they contain the total *capillaris* or *setosa* complex with or without extra chromosomes. . . .

"The F_1 hybrid, having half of the *biennis* chromosomes, is an annual. This indicates either the activity of the *setosa* haploid set of chromosomes or that reduction of the number of chromosomes in this case results in a change from biennial to annual. The F_1 *C. setosa* \times *C. biennis* can not revert to the parent species through back crossing because of the pairing of the *biennis* chromosomes of the F_1 during meiosis. The back crosses to *C. biennis*, which have 10 less *biennis* chromosomes than *C. biennis*, show no *setosa* characteristics in the rosette stage. In these crosses the species contributing the greater number of chromosomes was dominant. In *C. setosa* \times *C. capillaris*, *C. setosa* was dominant, while in *C. setosa* \times *C. biennis*, *C. biennis* was dominant. It is possible to propagate the hybrids and their parents by asexual means. Self-fertilized seeds were found to set on *C. setosa* \times *C. biennis* F_1 hybrids in the garden, but failed to set in the greenhouse. The F_1 *C. setosa* \times *C. capillaris* failed to set selfed seed in the greenhouse but was not tested in the field."

Studies on the inheritance of the weight of new-born rabbits, S. KOPEĆ (*Jour. Genetics*, 14 (1924), No. 2, pp. 241-263, figs. 2).—In a study of the inheritance of birth weight in rabbits at the Government Institute for Agricultural Research at Puławy, Poland, crosses were made between Himalayan and Silver rabbits, and the birth weights of the offspring were compared with the birth weights of the offspring of the same females when mated with males of the same variety. F_2 s and F_3 s were also produced in the crosses of Himalayan females with Silver males, F_2 s only being produced in the reciprocal cross. The average birth weights of the young of the different generations and breeding, as well as other data, are given in the following table:

Average weights and other constants of young of different generations and breeding

Mating	Average weight	Standard deviation	Average size of litter	Number of offspring
	Grams	Grams	Number	
Himalayan ♀s \times Himalayan ♂s.....	35.92 \pm 0.33	5.73	4.8	139
Silver ♀s \times Silver ♂s.....	44.19 \pm .34	5.08	4.8	101
Himalayan ♀s \times Silver ♂ F_1	41.91 \pm .37	5.50	4.6	102
Himalayan ♀s \times Silver ♂ F_2	41.06 \pm .37	7.68	5.2	198
Himalayan ♀s \times Silver ♂ F_2 , Himalayan selections.....	41.42 \pm .68	7.22	5.2	51
Silver ♀s \times Himalayan ♂ F_1	43.30 \pm .39	4.60	4.9	63
Silver ♀s \times Himalayan ♂ F_2	41.26 \pm .60	8.94	4.8	101
Silver ♀s \times Himalayan ♂ F_2 , Himalayan selections.....	42.16 \pm .91	7.38	4.7	30

Much variation among the average weights and the variability of the offspring of individual dams was obtained, the usual biometric constants being tabulated for each of the seven Himalayan does and four Silver does. The author concludes from the results that the inheritance of birth weight in rabbits may be considered as Mendelian and is governed by multiple factors. In the Himalayan ♀s \times Silver ♂ crosses, the birth weights of F_1 s were intermediate between the two varieties without significant changes in the F_2 s except

for an increase in variability. F_1 s were essentially the same as F_2 s, except that the offspring of one individual were significantly greater and of another significantly less in weight. The F_1 s of the reciprocal cross were nearly as heavy as the heavier parent, with a decrease to intermediacy in the F_2 , accompanied by an increase in variability. Young bearing the Himalayan pattern in the F_2 showed no relationship to the weight of purebred Himalayans, and it is, therefore, concluded that birth weight and Himalayan pattern are inherited independently.

Genetics of the Japanese rabbit, W. E. CASTLE (*Jour. Genetics*, 14 (1924), No. 2, pp. 225-229).—The experimental results are discussed from which the conclusions as to the genetic factors involved in the production of the Japanese pattern in rabbits were derived (*E. S. R.*, 52, p. 222).

On the "Japanese" rabbit, R. C. PUNNETT (*Jour. Genetics*, 14 (1924), No. 2, pp. 231-240).—The results of several experiments in studying the genetic factors determining the Japanese pattern in rabbits have indicated, in conformity with Castle's conclusions, that this pattern is a fourth allelomorph in the yellow series. It is suggested that it bears the same relation to dominant black as tortoise does to recessive black, but that in the former case black hairs may usually be found in the yellow areas. The four members of the allelomorphic series, dominant black, Japanese, recessive black, and tortoise shell, may correspond to four stages of melanic pigmentation.

Notes on experiments by J. B. S. and L. K. Haldane have indicated a one factor Mendelian relationship between Japanese and yellow or tortoise shell. These experiments have also shown that a buck having only two small patches of black was genetically heterozygous for the Japanese pattern, and transmitted the condition as well as would be expected by a heterozygous male showing the more typical Japanese pattern.

The genetics of the Wensleydale breed of sheep.—I, **The occurrence of black lambs**—an examination of flock records, F. W. DRY (*Jour. Genetics*, 14 (1924), No. 2, pp. 203-218).—The results of a study of the inheritance of various characters in Wensleydale sheep, based on flock records, are given from the University of Leeds. The typical Wensleydale sheep has white wool, with the skin of the face and ears of a deep blue color. Variations, however, occur in purebred flocks, some having black wool and some having a pale skin color of the face and ears.

Breeding records of 3,015 lambs born during 25 years at the Underley Farm near Kirkby Lonsdale were used mainly in this study, though less extensive and less authentic records of other breeders were also employed. From the records at the Underley Farm, omitting the offspring of one ram that sired no black lambs, 13.3 per cent of the lambs were classified as pale, 66.2 per cent blue (typical color), and 20.5 per cent black. No significant differences in the proportions of the three types occurred in the different years of the investigation. Though no black sheep and few pale sheep were used for breeding purposes, the percentages of black sheep occurring among the offspring of ewes producing at least one black lamb agreed very closely with the expected numbers if black were due to a simple recessive Mendelian character.

Records from other flocks indicated that blacks mated with blacks produced only blacks, though one lamb of a dirty brownish-gray color was reported. Data of sufficient extent and accuracy were not available for analysis of pale pattern, gray hairs in a black coat, and other similar variations.

The inheritance of pubescent nodes in a cross between two varieties of wheat, H. H. LOVE and W. T. CRAIG (*Jour. Agr. Research [U. S.]*, 28 (1924),

No. 8, pp. 841-844).—The character pubescent node as found in a variety of wheat known as Velvetnode behaved as a simple (3:1) dominant when the bearded, glabrous glumed Velvetnode was crossed with a beardless wheat having pubescent glumes and glabrous nodes. Pubescent node seems to be very closely linked with the bearded condition. Further tests are expected to show whether the few aberrants noted are crossovers or may be explained otherwise. Pubescent glume, considered alone, segregated in a simple (3:1) ratio with pubescence dominant.

Linked inheritance of certain characters in the adzuki bean, Y. KAKIZAKI (*Genetics*, 8 (1923), No. 2, pp. 168-177).—It becomes increasingly evident from studies of both plants and animals that the various hereditary characteristics of organisms, and their determiners or factors, are inherited in more or less closely linked groups (and not independently as was assumed in earlier Mendelian studies), these linkage groups being held together, perhaps, by chromosomes. In the present paper the author reports an instance of this kind from his crossing experiments employing the adzuki bean (*Phaseolus chrysanthos*), in which three distinct characters are considered, namely, stem color, seed coat black spotting, and ripe pod color, the variety Miyako having green stems, brown seed pods, and unspotted red seed coats, and Donsu having light reddish-purple stems, blackish-brown seed pods, and seed coats intensely black spotted on red ground color. The results of the work are tabulated and discussed as done with three generations of the hybrid progenies and of the parental strains.

"The factor *P* for reddish-purple color of stems and its recessive allelomorph *p* (green stems) are very closely linked with *S*, a factor for black spotting of seed coats, and its recessive allelomorph *s*, respectively, and hardly any crossing over occurs between them. The *I* factor which intensifies the purple color of the stem, and its recessive allelomorph *i* are also very closely linked with the *B* factor which produces a blackish-brown color of the ripe pods, and *b*, its recessive allelomorph, and this linkage is also very close, so that crossing over hardly ever occurs between them. The *P-S* linkage group is independent of the *I-B* linkage group. Presence of *S* in a homozygous condition produces more intense spotting of the seed coats than when it is present in a heterozygous condition."

Sex ratio data for two chalcid egg parasites of the coffee bug (*Antestia lineaticollis*), F. W. DRY (*Jour. Genetics*, 14 (1924), No. 2, pp. 219-224).—A study, at the Leeds University, of the sex ratios of *Hadronotus antestiae* and *Telenomus truncativentris*, two parasites of the coffee bug, based on collections and laboratory matings, showed that there were only about 20 per cent of males in the populations. It was found that both species can apparently produce males asexually, but bisexual reproduction is the rule, in which the females outnumber the males by about 3 or 4 to 1.

Notes on the genitalia of a crowing hen, J. B. GATENBY and F. W. R. BRAMBELL (*Jour. Genetics*, 14 (1924), No. 2, pp. 173-183, figs. 4).—The genitalia of a White Leghorn fowl showing hen characteristics except for its head, which resembled that of a cock, are described from the Trinity College, Dublin. The bird crowed loudly and often, and showed some indications of courting hens, though it also attacked them. Upon making a post-mortem examination of the bird, large amounts of fat were found in the abdominal cavity. Only one gonad was located which, on section, contained scar tissue. Portions of the gonad resembled tubules of a testicle, and other portions possibly resembled ducts. Much hemorrhage was present between the gonad and the peritoneum which extended into the gonad, but could not be called an adenoma. Peculiar new growing tissue, derived from the peritoneum and staining like testicular

tubules, was found completely outside of the gonad. Normal spermatogenic tubes with spermatogonia were not present. The authors discuss the possibilities of various conditions overriding sex determination by chromosomes in the production of intersexual individuals.

FIELD CROPS

Native American forage plants, A. W. SAMPSON (*New York: John Wiley & Sons, Inc., London: Chapman & Hall, Ltd., 1924, pp. XXV+435, pl. 1, figs. 199*).—The present work deals with the more important native forage plants embraced in the natural pasture types of this country. Part 1, *Plant Life of the Pasture*, discusses the application of the principles of botany, the general structure and composition of pasture plants, the laws of plant physiology as related to grazing, the environment of native forage plants in relation to pasture management, and the classification of forage plants. Part 2, *Important Native Forage Plants*, treats of forage genera and species with respect to their identity and distribution, their growth requirements and life history, and their forage value for different classes of livestock.

Forage plants and their culture, C. V. PIPER (*New York: Macmillan Co., 1924, rev. ed., pp. XXV+671, pls. 14, figs. 74*).—The information and statistics are revised in this edition of a book noted earlier (*E. S. R.*, 32, p. 827), and lists of pertinent publications are appended to each chapter.

[**Agronomic work in Michigan**], F. A. SPRAGG and C. R. MEGEE (*Michigan Sta. Rpt. 1923, pp. 236-243*).—Breeding work with alfalfa, barley, beans, corn, crimson clover, hemp, annual sweet clover, oats, potatoes, rye, sugar beets, and wheat is reviewed briefly, and comment is made on the behavior of clover and alfalfa seed from different sources (*E. S. R.*, 47, p. 829), strains of sweet clover, and soy bean varieties.

Annual report of the Northeast Missouri Crops Experiment Field (1924), W. C. ETHERIDGE and C. A. HELM (*Missouri Sta. Circ. 128 (1924), pp. 2*).—Poole wheat gave high yields and lodged very little in spite of a very unfavorable season, whereas Fulcaster and Harvest King, although yielding heavily, lodged badly in the limited variety test here reported.

Experiments in seed production with different grasses, red clover, and bird's-foot clover [trans. title], E. LINDHARD and H. BAGGE (*Tidsskr. Planteavl, 29 (1923), No. 5, pp. 673-763*).—Seed culture tests with orchard grass, timothy, tall oat grass, meadow fescue, Italian rye grass, English rye grass, *Poa fertilis*, bird's-foot clover, and red clover, conducted for a series of years at different experiment stations in Denmark, are described and the results summarized.

Orchard grass was sown broadcast at the rates of 9, 13.5, 18, and 22.5 kg. per hectare and in drills 30, 45, and 60 cm. apart at the three lower rates only. The first year the broadcasted plats produced the best yields of seed, but the average yields for the second and third and the fourth to the seventh years, inclusive, were largely in favor of the drilled plats. In general, the lower rates of seeding and the greater distances between the drilled rows gave the best results.

Timothy, in two and three-year tests at three experiment stations, was sown broadcast at the rates of 6 and 10 kg. per hectare and drilled in rows 35 cm. apart at the rates of 3.4 and 5.1 kg. per hectare and in rows 50 cm. apart at the rates of 2.4 and 3.6 kg. per hectare. The results indicated that timothy, unlike orchard grass, can be made to produce a full yield of seed at the first harvest. The highest average yields of seed were secured from drilling in

rows 35 cm. apart, but the highest yields of hay came from the plats sown broadcast.

Tall oat grass produced the largest average yield of seed when sown at the rate of 12 kg. per hectare in drills 60 cm. apart, this being the lowest rate of seeding and the largest distance between rows in the test. This grass gave the best yields of hay when sown broadcast at the rate of 40 kg. per hectare, but the seedings at the rate of 24 kg. per hectare gave only 100 kg. of hay per hectare less.

The results with meadow fescue led to the conclusion that the largest and surest yields of seed are secured from drilling in rows 40 cm. apart at the rate of about 6 kg. of seed per hectare.

Italian rye grass produced 469 kg. of seed per hectare more from rows 12 cm. apart sown at the rate of 16 kg. of seed per hectare than from rows 36 cm. apart at the rate of 8 kg. per hectare. A comparison of Italian and English rye grass did not show marked differences in the average yields of either seed or hay.

Experiments with *Poa fertilis* indicated that this grass ranked close to timothy in seed production and in cultural requirements.

Bird's-foot clover, throughout a number of tests, gave the highest seed yields from comparatively thin seedings. The rate of 4 to 6 kg. of seed per hectare is recommended for drilling in rows 30 cm. apart. On the broadcasted plats from 6 to 9 kg. of seed per hectare gave the best results.

Early red clover produced the most seed from the second cutting, after the first growth was cut for hay the third week in May, while late red clover gave the best returns of seed from the first cutting. In each case the first cutting gave the largest yield of hay.

Some factors affecting the water absorption and germination of seed corn. G. H. DUNGAN (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 8, pp. 473-481).—Experiments at the Illinois Experiment Station were concerned with the effects of the stage at which the corn is harvested and of the chemical and physical composition of the corn kernel on the water absorption and germination of seed corn.

Seed corn harvested before complete maturity absorbed water more rapidly and also possessed a greater absorptive capacity for water than corn allowed to mature on the stalk. Corn containing a high proportion of soft starch in the endosperm imbibed water more rapidly than corn of the same variety having an endosperm with a lesser proportion of soft starch. Conversely, a high proportion of horny starch in corn reduced water absorption. This held true in corn selected on the germinator for disease freedom and susceptibility, as well as in corn that had been selected for many generations because of its high protein content. Both the high-protein corn and corn nearly disease-free were relatively high in horny material, and their rates of water absorption were comparatively low.

Rapidity of water absorption was associated with quick germination, although seedling vigor more often accompanied horniness of the kernel. While high-protein corn tended to begin germinating slowly, when once started it exhibited seedling vigor far superior to that of the low-protein corn. Mature seed corn germinated somewhat slower but more vigorously than corn of the same variety harvested before maturity. Corn containing a large quantity of moisture during storage germinated quicker but with less vigor than corn containing a smaller quantity of storage moisture. Corn possessing a moisture content of 6.1 per cent germinated slower and with a slightly lower percentage vitality than corn having 12.6 per cent moisture.

The relative effects of foreign pollen upon the kernel weight of commercial varieties and selfed strains of corn, T. A. KIESSELBACH and G. C. COOK (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 1, pp. 30-36).—The immediate effects of fertilization by foreign pollen upon the kernel weights of selfed strains, commercial varieties, and various botanical types of corn were compared at the Nebraska Experiment Station.

Eight combinations of selfed strains fertilized by foreign dent pollen gave an average increase in kernel weight of 11.9 per cent, explainable only by heterosis. The increase due to a change in endosperm type, which occurs with sweet corn when fertilized by a starchy type, was also marked, amounting to an average of 19.9 per cent for 6 such sweet dent combinations. This increase may have been slightly modified by a change in heterosis, since 2 commercial sweet corn varieties pollinated by other sweet varieties gave an increase of 1.9 per cent in kernel weight.

Commercial varieties of corn, being heterozygous, responded relatively little to the immediate effect of foreign pollen as a result of heterosis, 158 dent combinations on 12 standard dent varieties making an average increase of 0.2 per cent. Thirteen combinations of dent by other types, including flint, pop, flour, and sweet, gave an average reduction of 0.2 per cent for the weight of hybrid kernels. Commercial varieties differ somewhat in the degree of response to foreign pollen, due probably to a difference in their heterozygosity. The extreme range of effect due to heterosis noted for more than 250 variety combinations made at the station was from a decrease of 2.3 to an increase of 5.6 per cent.

The effect of the opening processes upon the staple of cotton, G. A. R. FOSTER (*Jour. Textile Inst.*, 15 (1924), No. 7, pp. T363-T370, figs. 21).—After bales of American, Queensland, Sakellaridis, and a mixing of Sea Island cotton had been subjected to opening processes involving bale breakers, feeders, openers, and scutchers with various speeds and settings, examinations at Shirley Institute showed that the mean staple lengths of the cottons had not been altered by the opening processes and the fibers were not weakened appreciably.

Community cotton production, O. F. COOK and R. D. MARTIN (*U. S. Dept. Agr., Farmers' Bul.* 1384 (1924), pp. II+21).—The one-variety community method of cotton production is outlined, and comment is made on the merits of the system. The subject has been discussed in greater detail in a previous publication (*E. S. R.*, 48, p. 530).

Cotton production, W. R. PERKINS (*La. Agr. Col. Ext. Circ.* 70 (1924), pp. 10).—Practical instructions for growing the crop in Louisiana.

Cotton production in Virginia, G. W. PATTESON, JR. (*Va. Agr. Col. Ext. Bul.* 86 (1924), pp. 16, figs. 5).—Available information on cotton production in Virginia is presented with the results of variety tests, by E. T. Batten, at the Holland Substation. Trice, King, and Cleveland, with average acre yields of 1,175, 892, and 833 lbs. of seed cotton per acre, led the varieties in the order named, and their use is recommended.

The dasheen, a southern root crop for home use and market, R. A. YOUNG (*U. S. Dept. Agr., Farmers' Bul.* 1396 (1924), pp. II+36, figs. 26).—The characteristics, composition and food value, and varieties of the dasheen are described, and information is given concerning its history in the United States and practices involved in the production, harvesting, storage, and marketing of the crop, with notes on diseases and insect pests. The uses of dasheen for stock feed, as a source of flour, starch, and industrial alcohol are touched on briefly, and a number of recipes for culinary use are included.

A study of flax and kindred fibres.—III, The microscopic structure of "tendered" fibres, G. O. SEARLE (*Jour. Textile Inst.*, 15 (1924), No. 7, pp. T371-T384, pls. 17).—The series of observations on fibers tendered by age, mineral acids, heat, oxidation, desiccation, light, and moisture, described in this contribution from the Linen Industry Research Association (E. S. R., 50, p. 134) appears to prove that the immediate cause of the loss in strength of such fibers is the development of planes of weakness running transversely to the fiber axis.

These planes of weakness apparently consist of the sum of a number of minute twinning or gliding planes running at an angle of approximately 60° across the spiral components of the fiber. In the normal fiber at least some of the major planes of weakness are visible as "dislocation" or transverse markings. Since the dislocation marks show a differential staining with iodine solution, and it has been suggested that there is a depolymerization of the cellulose wherever they occur, it is probable that the cellulose at these points is more easily oxidizable or hydrolyzable than the normal cellulose, and that these points are the first attacked, on tendering, with the consequent formation of complete planes of segmentation transverse to the fiber.

Although W. Muller² has shown that even in the normal fiber the greater the number of dislocation marks the less its strength, the present observations indicate that the formation of a dislocation mark does not mean a break in the continuity of the spiral component, fibers with a large number of dislocation marks on being compressed in caustic soda showing their spiral components in an unsegmented condition. The loss in strength of tendered fibers does not appear to be caused by the spiral components of the fiber slipping over one another, although a separation of these components into discrete entities can be brought about by pressure. Segmentation takes place only with the change of the cellulose at the dislocation mark by oxidation or hydrolysis.

Production of henequen fiber in Yucatan and Campeche, H. T. EDWARDS (*U. S. Dept. Agr. Bul.* 1278 (1924), pp. 20, figs. 10).—Based on field studies in Yucatan and Campeche in June and July, 1923, a report is made on the soil and climatic conditions in these States, geographical distribution, cultivated areas, and varieties of henequen (*Agave fourcroydes*), organization and management of henequen plantations, preparation and handling of the fiber, and the present market situation and future of the crop. The binder twine fiber situation is discussed briefly. The author thinks that with stable economic, industrial, and political conditions in Yucatan, and with no material change in the present prices of the fiber, the supply of henequen fiber, supplemented by other hard fibers, should be adequate during the next few years to meet the world demand.

Variety tests with oats, 1915-1920 [trans. title], J. C. LARSEN (*Tidsskr. Planteavl.*, 29 (1923), No. 1, pp. 56-94).—The results of comparative tests with several improved varieties of oats, conducted for six years at three Danish insular experiment stations and five stations in Jutland, are reported. The different varieties are described as to quality and season.

Sejr oats, a Svalöf selection from Milton, an American sort, gave the highest yields of grain and straw on the islands, while in Jutland this variety stood fifth in the yield of grain. On the islands Sejr yielded at the rate of 86.15 bu. per acre as compared with 61.15 bu. on the mainland, where the yields of all varieties were generally lower. Sejr, Kron, and Gul Naesgaard, the leading varieties, stood about equal in strength of straw, earliness, and percentage of hull, all these factors being quite favorable.

² *Faserforschung*, 1 (1921), No. 1, pp. 1-25.

Potato growing in Kentucky, J. S. GARDNER and C. W. MATHEWS (*Kentucky Sta. Circ. 34* (1924), pp. 23-58, figs. 20).—Cultural methods and field practices are recommended for potato production in Kentucky, with comment on varieties, seed, and control of insects and diseases.

Potato culture [trans. title], J. H. LAVOIE (*Min. Agr. Prov. Québec Bul. 87* (1924), pp. 119, figs. 19).—Intended primarily for conditions in Quebec, this publication presents in French practical information concerning the characteristics, varieties, and soil, climatic, and cultural requirements of the potato, with observations on seeding and seed improvement, fertilizers, harvesting, storage, and marketing.

Size of seedling tests with special reference to the rate of seeding and relative yields [of rice], J. P. TORRES (*Philippine Agr. Rev., 17* (1924), No. 1, pp. 13-20).—Having transplanted large and small seedlings of the Ramai and Tadung varieties of rice in comparison, the author found that the small seedlings were less resistant to conditions than the large type, the stands averaging 59.65 and 87.13 per cent, respectively. Large seedlings produced more culms per plant and gave higher average yields of grain per plant and per unit area than the small seedlings. On the other hand, the length of culm was only slightly affected by the size of the transplanted seedlings. The ratio of large to small seedlings in the seed bed was in inverse proportion to the rates of seeding.

The effect of spacing on tillering and production of three varieties of rice, P. A. RODRIGO (*Philippine Agr., 13* (1924), No. 1, pp. 5-28).—When three varieties of rice were transplanted at spacings ranging from 10 by 10 cm. (3.93 in.) to 40 by 40 cm., increase in the space allowed per plant was accompanied by increased numbers of fruiting culms, whereas the number of fruiting culms per unit area decreased. Spaced at 10 by 10 cm., Daluson plants averaged 1.82 fruiting culms, Murmuray 1.49, and Diquet a Bolilising 1.76, while at 40 by 40 cm., average numbers of 11.22, 10.95, and 11.65 culms, respectively, were obtained. Distances of 30 by 30 cm. gave the highest yields and net values for the first two varieties and 25 by 25 cm. for the last named.

The distance between hills did not affect the distribution and the growth of weeds during the early growth of the plants. The date of flowering was slightly affected by the transplanting distance, the plants in the plats with hills at 30 by 30 cm. and 40 by 40 cm. heading out a few days later. The range of flowering season was greater in plats with hills 40 by 40 cm. apart. In these particular plats the tillering of the plants was more free, and the growth in general was more vigorous.

The saving in seed and labor possible at the wider spacings is pointed out.

A study of the relation of different amounts of water supply to growth, straw, and seed production of rice, R. A. REYES (*Thesis, Col. Agr., Univ. Philippines [Los Banos, Laguna]; abs. in Philippine Agr., 13* (1924), No. 1, p. 55).—In a study of the influence of the water supply on the growth, straw, and grain production of both lowland and upland varieties of rice, a high percentage of moisture gave the higher yields of straw and grain and a low percentage of moisture gave markedly low yields. A wide difference was found in the moisture requirements of upland and lowland varieties of rice, and the amount of water needed for heavy grain production was directly proportional to the yield. Tillering was more abundant in rich soil than in poor soil.

The effect of several mineral fertilizers upon the nodulation of Virginia soy beans, A. T. PERKINS (*Soil Sci., 17* (1924), No. 6, pp. 439-447).—A study of the effect upon nodulation of soy beans of the four essential ele-

ments most likely to be limiting factors is reported from the New Jersey Experiment Stations.

When lime was absent or present in only small amounts nodulation was greatly limited. The salt balance appeared to have little effect on nodulation when a small amount of lime was present. Varying the amounts of acid phosphate gave indications that phosphate was not essential for the nodulation of young soy bean plants. A close relation between root development and nodulation was noted. Applications of potassium choride up to and including 500 lbs. per acre had no appreciable effect upon nodulation, and greater applications inhibited the symbiotic relationship. Maximum nodulation was not obtained with applications of limestone under 500 lbs. per acre, and larger applications did not cause increased nodulation. Where from 0 to 3,000 lbs. of sodium nitrate per acre was applied to the soy beans, the results indicated that small applications of nitrogen (up to 250 lbs. per acre of sodium nitrate) increase nodulation slightly, but that fixed nitrogen is not needed for good nodulation and that heavy applications inhibit the infection of the host.

The author concludes that elements essential for plant growth do not directly affect the infection and nodulation of legumes.

A note on the nodulation of soy beans, A. T. PERKINS (*Soil Sci.*, 17 (1924), No. 6, pp. 449-456).—Efforts to determine why essential elements favor nodulation under agricultural conditions and often tend to limit it under the conditions of these experiments embraced studies of the effect of phosphate, of osmotic pressure, and of lime upon nodulation and the effect of increasing applications of essential elements upon toxicity to nodulation induced by non-essential elements. The results suggested that when phosphorus and potassium increase nodulation they may do so by counteracting some toxic factor in the soil. Calcium may increase nodulation by counteracting some toxic factor in the soil, by entering directly into either the process of infection or nitrogen fixation, or as a result of being the first element to limit the growth of the seedlings by its absence. Under the conditions of these experiments, when the elements under consideration affect nodulation they may possibly do so by disturbing the physiological activities of the plants.

Experiments with sugar beets from seed produced by selected and unselected roots [trans. title], E. LINDHARD (*Tidsskr. Planteavl*, 29 (1923), No. 2, pp. 321-328).—The average results in 1922 of three field tests at as many different points showed that the seed from the largest or selected roots, as compared with that from unselected roots, produced a small increase in yield of roots with a slight decrease in sugar and dry matter content. Both lots of seed had a germination of about 87 per cent.

Culture experiments with sugar beet strains, 1922 [trans. title], E. LINDHARD (*Tidsskr. Planteavl*, 29 (1923), No. 1, pp. 95-116).—Seven Danish strains of sugar beets were compared in 1922 with a Swedish strain and a German strain.

The average results as to yield of beets and sugar content indicated that in quantity of sugar produced most of the Danish strains stood equal to or between the two standard strains. As compared with these strains, the Danish sorts produced in general a somewhat higher yield of beets but with a slightly lower percentage of sugar.

Spacing experiments with sugar beets in Moravia in 1923 [trans. title], F. CHMELÁK and J. ŠIMON (*Ztschr. Zuckerindus. Čechoslovak. Repub.*, 48 (1924), Nos. 39, pp. 309-316; 40, pp. 317-323; abs. in *Com. Cent. Fabric Sucre France, Circ. Held.*, 36 (1924), No. 1843, pp. 341, 342).—Experiments with Dobrowitz and Schreiber sugar beets continued in 1923 gave results in general accord with those obtained earlier (E. S. R., 50, p. 737). The influence on the

beets of the different spacings, 40 to 60 cm. between rows, and 25 to 30 cm. between plants in the row, can be summarized as follows:

The absolute weight of the root increased when the distance between or within rows was increased. Increases of 12.5, 25, and 50 per cent in the area per beet increased the weight of the roots from 8 to 12 per cent, 15 to 19, and 35 to 41 per cent, respectively. The effect of increased space on bifurcation of the beets was insignificant, the maximum amount of forked beets being 3.3 per cent in 60-cm. rows. Extended spacing seemed to prolong growth and delay maturity.

Increased spacing between and within the row reduced the sucrose content of the root but little, a reduction averaging only 0.59 to 0.44 per cent for the two varieties resulting from widening the rows from 40 to 60 cm. The dry matter content of the root suffered a maximum reduction of 0.98 per cent, and the nitrogen content of the dry matter rose very slightly, 0.04 per cent at most. The yields of roots, leaves, and sugar per unit area in 1923 were reduced by increased spacing, the greatest reduction at the widest spacing, 60 by 30 cm., amounting to 11 per cent in the sugar yield, and from 8 to 10 per cent in the root yield. The closest spacing, 40 by 25 cm., again produced the best results with both varieties.

Taros and yautias, promising new food plants for the South, R. A. YOUNG (*U. S. Dept. Agr. Bul. 1247 (1924), pp. 24, pls. 11, figs. 16*).—The general characteristics, uses, and the relationship of taros (*Colocasia* spp.) and yautias (*Xanthosoma* spp.) are set forth with keys to the vegetative characters. Among the several *Colocasias* described are the blue tanyah, Ong-hwa taro, dasheens, small tubered Japanese taros, Penang taro, yellow tanyah, and igname branca. Important *Xanthosomas* dealt with include the Rolliza, Picauncucha, Malanga coloré, Nut eddo, and belembe yautias.

How long do the various seed species retain their germination power? K. DORPH-PETERSEN (*Internatl. Rev. Sci. and Pract. Agr. [Rome], n. ser., 2 (1924), No. 2, pp. 283-301*).—Investigations on the longevity of different agricultural and weed seeds were carried on at the Danish State Seed Testing Station between 1891 and 1920.

In tests made on single lots of each species, seeds of the legumes with good initial germinability retained it almost unaltered in the third year. During the following years germinability decreased, while the content of hard seeds in most cases was nearly constant. In some of the samples, i. e., *Trifolium repens*, *T. hybridum*, and *Lotus corniculatus*, a few seeds still germinated after 25 years, and the samples contained some hard seeds.

Seed of grass species having a high initial germinability also retained it nearly unaltered for 3 years, exceptions being *Bromus arvensis*, *Alopecurus pratensis*, and *Secale cereale*. Only a few of the grasses keep their germination power more than 7 to 8 years. Although oats showed an initial germination considerably below normal, they retained the power of germination longer than samples of wheat, barley, and rye, which had higher initial germination power.

Samples of *Beta vulgaris*, *Brassica napus rapifera*, and *B. campestris rapifera* kept their power of germination almost unaltered until the ninth year, after which a decrease took place, although still exceeding 50 per cent in the tenth year. Seed of *Daucus carota* decreased in germinability somewhat in the second year, with an equal reduction annually thereafter, the seed being dead in the ninth year. Seed of cruciferous plants seem to retain the power of germination comparatively long, while umbelliferous lose their power of germination more rapidly.

The seed of Coniferae showed a regular decrease in germinability after the first year. However, samples of *Pinus silvestris* and *P. montana* contained, in the fourteenth year, a few seeds still able to germinate.

Several samples of each of the more important species of legumes, grasses, and root crops were studied in a series commenced in 1902-3. According to the investigations, samples having a high initial germinability and only a few or no hard and dead seeds lose this power faster than samples containing many hard seeds but no dead seeds, apparently because the hard seeds are, as a rule, the ripest and best developed and contain comparatively less water than the other seeds in the sample. It appears that well-germinating seeds of the legumes tested (red clover, white clover, alsike, alfalfa, and medic), stored under drier conditions than in commercial storerooms and germinated under more favorable circumstances than in practice, retain their germination power unaltered in the second and third year, but in the fourth year an essential reduction continuing during the following period will take place. The rapidity of germination, which decreases earlier than the germination power, is in some cases a little lower the second year than the first. Other investigations showed that the germination power in the soil bears a close relation to the speed of germination of the seed. In the case of two seed consignments with the same power but different speeds of germination, the seeds with the highest speed should always be preferred. The various species of grass seed also retain the germination power differently. The studies suggest that when the grass seed has a good speed and power of germination the first year and is stored under favorable conditions, it can keep the germination power unaltered for two years.

HORTICULTURE

My garden book, J. WEATHERS (*London and New York: Longmans, Green & Co., 1924, pp. XVI+774, pls. 24, figs. 392*).—This comprehensive treatise, illustrated in part in color, embraces both the scientific and practical viewpoints and covers the entire field of horticulture—ornamentals, vegetables, and fruits.

The vegetable garden, I. D. BENNETT, rev. by A. KRUEH (*Garden City, N. Y.: Doubleday, Page & Co., 1923, rev. and enl. ed., pp. XII+231, pls. 27*).—A revised and enlarged edition of a previously noted work by Bennett (E. S. R., 21, p. 440).

Vegetable culture, J. DYBOWSKI (*Traité de Culture Potagère., Paris: J.-B. Baillière & Sons, 1924, 5. ed., rev., pp. XII+340, figs. 130*).—This, the fifth and revised edition, contains general cultural information on both the common and rare kinds of vegetables.

[Horticultural investigations at the Rosthern, Sask., Experimental Station], W. A. MUNRO (*Canada Expt. Farms Rosthern (Sask.) Sta. Rpt. Supt. 1923 pp. 23-34, fig. 1*).—This comprises for the most part brief varietal and cultural notes on numerous fruit, vegetable, and ornamental plants (E. S. R., 49, p. 832).

[Plant breeding activities at the Vineland (Ont.) Horticultural Experiment Station] (*Ontario Min. Agr. Rpt. 1923, pp. 41, 42*).—This is a brief progress report upon breeding work with various vegetables and fruits. The Viking raspberry, one of the station's productions, showed much promise during the year.

Grapes, peaches, melons, and how to grow them, T. W. SANDERS and J. LANSDELL (*London: W. H. & L. Collingbridge, 1924, pp. 144, pls. 19, figs. 40*).—A handbook dealing with history, culture, management, and propagation from the viewpoint of the English glasshouse grower.

Asparagus, LOISEL, rev. by F. LESOURD (*L'Asperge*. Paris: Libr. Agr. Maison Rustique, [1924], 10. ed., rev., pp. [3]+VII+136, figs. 46).—A small handbook dealing with the culture of asparagus in the field, greenhouse, and frames.

The mushroom industry of Pennsylvania, C. R. MASON (*Penn. Dept. Agr. Bul.* 392 (1924), pp. 28, figs. 10).—Stating that Pennsylvania produces 85 per cent of the mushrooms grown in the United States, the author discusses the present status of the industry, taking into consideration equipment, cultural practices, harvesting, marketing, etc.

American fruits, S. FRASER (*New York: Orange Judd Pub. Co., Inc.; London: Kegan Paul, Trench, Trübner & Co., Ltd.*, 1924, pp. XV+888, figs. 173).—A comprehensive and well-illustrated manual relating to the propagation, cultivation, harvesting, distribution, and marketing of the various fruits grown in North America, paying particular attention to the apple, pear, peach, and plum.

Importance of proper pollination in fruit yields, E. C. AUCHTER (*Md. Agr. Soc., Farm Bur. Fed., Rpt.*, 8 (1923), pp. 171-182).—A general discussion of apple pollination, emphasizing in particular the results of studies, carried on at the Maryland Experiment Station, showing the sexual status of numerous varieties and indicating varietal combinations insuring satisfactory pollination.

[**Fruit pollination**], C. H. HOOPER (*Fruit, Flower, and Veg. Trades' Jour.* [London], 46 (1924), Nos. 25, pp. 696, 697; 26, pp. 735-737).—A summary of the results of English investigations and experiences in the pollination of small fruits, tree fruits, and nuts, setting forth those varieties which have been found self- or inter-sterile and recommending combinations which experience has shown to yield satisfactory crops of fruits.

New problems found in cherry pollination, C. E. SCHUSTER (*Better Fruit*, 19 (1924), No. 5, pp. 7, 8, 17, figs. 2).—A brief popular article in which the author, after calling attention to apparently inconsistent results in cherry pollination, states that such are likely due to the existence of seedlings so closely resembling parent varieties as to be often indistinguishable except on very close examination. A solution to the problem is offered in the asexual propagation of trees of proved pollinating capacities, for the determination of which a simple method of sacking blossoms with subsequent hand pollination is outlined for the benefit of the practical orchardist.

The cold storage of pears, E. L. OVERHOLSER and L. P. LATIMER (*California Sta. Bul.* 377 (1924), pp. 56, figs. 12).—Composed largely of data on the behavior in cold storage of individual varieties of pears, this bulletin also discusses several factors concerned in pear storage.

Pears kept best at from 30 to 32° F. except in the case of fruit harvested when relatively immature, in which condition 36° favored keeping and ultimate eating qualities. The stage of maturity at the time of harvest was found to have an important bearing on the size, flavor, and keeping quality, prematurely harvested fruit not only wilting badly but also failing to attain satisfactory color and flavor. Blue mold (*Penicillium* spp.), found to occur upon certain varieties at all temperatures utilized in the investigation, was retarded by temperatures in the vicinity of 32°.

Pears exposed to ammonia fumes suffered from blackening of the skin in the vicinity of the lenticels. This injury was particularly manifest in immature or moist fruits, and apparently was worse in certain varieties than in others.

Pear scald, found to occur at any of the temperatures used, was much less prevalent on fruits harvested at the proper stage of ripening. Of the many

varieties studied, Bartlett was found to be most subject to scald, followed by Comice, Louise, and Clairgeau.

Observations on the comparative keeping qualities of cross-pollinated and parthenocarpic Bartlett pears gathered from the same orchards showed the former to mature considerably earlier, indicating that crossed fruits need to be picked approximately two weeks earlier than seedless fruits. Records taken on Bartlett pears stored in a well-ventilated chamber showed a weight loss of 5.23 per cent during the nine days required for ripening.

Currants and gooseberries: Their culture and relation to white-pine blister rust, G. M. DARROW, S. B. DETWILER, ET AL. (*U. S. Dept. Agr., Farmers' Bul.* 1398 (1924), pp. II+38, figs. 27).—This bulletin, a revision of and superseding Farmers' Bulletin 1024, previously noted (*E. S. R.*, 41, p. 45), again presents, in addition to general cultural, varietal, and miscellaneous information, a discussion of the important relation between currants and gooseberries and the spread of white pine blister rust. A summary of State laws concerning currants and gooseberries in relation to blister rust control and a digest of State and Federal quarantines governing the movement of currant and gooseberry plants are included.

New grape varieties for California, G. C. HUSMANN (*Pacific Rural Press*, 108 (1924), No. 25, pp. 642, 643, figs. 5).—This article includes popular and technical descriptions of several promising vinifera grapes introduced by the U. S. Department of Agriculture into California, and which are deemed of value for extending the California grape season and in providing better shipping and table qualities.

The Almeria grape industry of the Old World, W. V. CRUESS (*Blue Anchor*, 2 (1925), No. 1, pp. 6-8, 30, 31, figs. 7).—This brief article contains personal observations upon the culture, varieties, harvesting, and transportation of the Almeria or so-called Malaga grape as grown in Spain.

The olive: Its culture and manufacture into oil, J. BONNET (*L'Olivier et les Produits de l'Olivier, l'Huile d'Olive*. Paris: J.-B. Baillière & Son, 1924, pp. 342, figs. 83).—This is a general discussion dealing with the culture and propagation of the olive tree, the manufacture and preservation of olive oils, and the preparation of preserved olives.

Avocado pollination tests, O. I. CLARK (*Calif. Avocado Assoc. Ann. Rpt.* 1923-1924, pp. 16-22, pls. 2).—Following suggestions made by Stout in an earlier paper (*E. S. R.*, 50, p. 238), parts of three Fuerte avocado trees were covered with netting, within which was confined a swarm of bees. Contrary to expectations, approximately the same number of fruits were produced within as without the nets. The inclusion of Fuerte, Blakeman, and Katherine Tingley varieties within a single tent did not result in as heavy production as occurred on portions of trees of the same varieties protected from cross-pollination. When insects were excluded by a netting from one-half of a Dickinson tree no fruit resulted, and at the same time the uncovered portion produced a heavy crop. A Fuerte branch grafted on a Challenge tree failed to assist in the setting of fruits, notwithstanding proved compatibility. Similar results were obtained with Harmon trees budded with Katherine Tingley shoots.

As a result of the study, the author suggests that nutritional conditions are of fundamental importance in determining the fruitfulness of the avocado. Apparently, well-matured branches possessing only a moderate amount of well-distributed new growth are requisite to productivity. The work with the Dickinson variety showed that insects are essential to fruitfulness, but likely not in the rôle of cross-pollinators.

The banana and its cultivation, with special reference to the British Empire (*Bul. Imp. Inst. [London]*, 22 (1924), No. 3, pp. 303-333, pls. 3).—Information is presented concerning the development and present status of the banana industry, taking into consideration botany, geographical distribution, and the adaptation of various British colonies to banana production.

The propagation and cultivation of citrus trees in Egypt, T. W. BROWN (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 44 (1924), pp. [VI]+88, pls. 30).—This is a general discussion relating to cultural practices, stocks, varieties, propagation, etc.

Date palm in Egypt, T. W. BROWN (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 43 (1924), pp. 39, pls. 11).—A popular discussion relating to the present status of the date-growing industry, cultural practices, varieties, pollination requirements, methods of harvesting and marketing, etc.

Walnut culture in California, L. D. BATCHELOR (*California Sta. Bul.* 379 (1924), pp. 3-91, figs. 34).—A comprehensive and general discussion of the various phases of Persian walnut production, including climatic and soil requirements, water supply, varietal descriptions, methods of propagation, planting, culture, combating insect and fungus pests, harvesting, curing, marketing, and probable revenues.

A handbook of Crocus and Colchicum for gardeners, E. A. BOWLES (*London: Martin Hopkinson & Co., Ltd.*, 1924, pp. XII+185, pls. 24).—This book discusses the culture and the botanical characters of the genera as a whole and of various species deemed worthy of planting for ornamental purposes.

The roses of Britain, A. H. WOLLEY-DOD (*London: Taylor and Francis*, 1924, pp. 112).—This comprises detailed descriptions of the wild roses known to grow in the British Isles, with notes on their peculiarities and relationships and on their comital distribution.

Roses, J. LACHAUME, rev. by G. BELLAIR (*Les Rosiers. Paris: Libr. Agr. Maison Rustique*, 19 ed., rev., and enl., pp. 192, figs. 80).—This is the nineteenth edition of a small handbook devoted to the culture, propagation, pruning, and use of roses.

Mountain flowers, L. MARRET (*Les Fleurs des Montagnes. Paris: Paul Lechevalier*, 1924, pp. CLXXVII+130, pls. 96, figs. 124).—This handbook, illustrated in part in color, contains descriptive and botanical notes on a large number of flowering plants.

Gardening in California: Landscape and flower, J. McLAREN (*San Francisco: A. M. Robertson*, 1924, [3 ed., rev.], pp. XII+395, pls. 28, figs. 126).—This well-illustrated book, devoted for the most part to plant materials, also contains information upon the planning and planting of home grounds. An earlier edition has been noted (*E. S. R.*, 20, p. 842).

The Soledad garden and arboretum: The Harvard Biological Institute in Cuba (Atkins Foundation) on Soledad Estate, D. FAIRCHILD (*Jour. Heredity*, 15 (1924), No. 11, pp. 451-461, figs. 8).—A brief account relating to the history, organization, and plant breeding activities of a privately owned Cuban arboretum, which, through the generosity and vision of its founder, also functions as the Harvard Biological Institute for Tropical Research.

Gardens of South Africa, D. FAIRBRIDGE (*London: A. & C. Black, Ltd.*, 1924, pp. VIII+213, pls. 16).—Illustrated in colors, this handbook contains general information concerning plant materials and garden arrangements in use at the present time in South Africa.

FORESTRY

Practical forestry from a workman's point of view, A. C. DRUMMIE (*London: George Routledge & Sons, Ltd., 1924, pp. XII+340, pls. 8, figs. 24*).—This book, prepared from the actual English workman's point of view, contains practical information on the planting, care, and utilization of forests.

A forest manual, P. RAZOUS (*Aide-Mémoire du Commerce et des Industries du Bois. Paris: Ecole de Sylviculture [etc.], 1924, pp. 382+XXXII, figs. 41*).—This book contains information relating to the cutting, transportation, and handling of lumber, lumber manufacture, the principal woodworking industries, and forest legislation.

Annual progress report of forest administration in the United Provinces for the period 1st April, 1922, to 31st March, 1923, H. G. BILLSON (*United Provs. [India] Forest Admin. Rpt., 1922-23, pp. [6]+38+XCIV+4*).—This, the usual annual report (E. S. R., 50, p. 345), is composed largely of statistical data concerning alterations in area, fire protection activities, forest output, etc. Detailed tabular reports are appended.

Aerial photography in forestry, logging, and engineering, E. WILSON (*Paper Indus., 6 (1924), No. 7, pp. 1207-1213, figs. 7*).—A brief popular discussion, in which the author outlines and discusses the methods and practices of mapping forests with the aid of the airplane.

A scheme for systematic identification of woods with the aid of a hand lens, J. L. BIENFAIT and J. P. PFEIFFER (*Jour. Forestry, 22 (1924), No. 7, pp. 724-761*).—The details are herein presented of a method of technique which has been successfully utilized in identifying species of woods, even those quite closely related. Detailed descriptions are included of important European forest species, together with a key deduced therefrom.

Studies in transpiration of coniferous tree seedlings, G. A. PEARSON (*Ecology, 5 (1924), No. 4, pp. 340-347, figs. 2*).—Transpiration measurements made in 1919 and 1920, at the Southwestern Forest Experiment Station of the U. S. D. A. Forest Service, located at Flagstaff, Ariz., upon seedlings of four species of native conifers showed the bristlecone pine to have the highest ratio of transpiration to accretion in dry weight, followed in order by western yellow pine, Douglas fir, and Englemann spruce. When water was withheld, all the species exhibited an unexpected resistance to transpiration, serious injury to the foliage being at first largely confined to the youngest shoots. No large or consistent differences were noted between the several species in respect to pulling power upon the soil water. Although no definite conclusions were drawn concerning relative persistence under wilting conditions, the bristlecone pine was apparently the most enduring species. Improved methods of technique suggested by the study are presented.

Western hemlock; red pine (*Canada Dept. Int., Forestry Branch Tree Pamphlets 5 (1924), pp. 7, figs. 2; 6, pp. 7, figs. 2*).—These pamphlets, continuing the general series (E. S. R., 50, p. 344), present brief notes on the habits and characteristics of the trees and the woods, general distribution of the species, etc.

The giant Sequoia, R. S. ELLSWORTH (*Oakland, Calif.: J. D. Berger, 1924 pp. 167, pls. 12*).—A popular discussion, in which the author discusses the paleobotany, early history, characteristics, and taxonomy of the Sequoia trees, stressing the need of preservation.

Timbers of tropical America, S. J. RECORD and C. D. MELL (*New Haven: Yale Univ. Press; London: Humphrey Milford, 1924 pp. XVIII+610, pls. 51*).—This is a well-illustrated book prepared in two parts, the first of which deals

with the tropical American countries and their forests and the second with the trees and their woods, paying particular attention to the anatomical characters which distinguish the species.

The story of rubber, J. W. STURMER (*Amer. Jour. Pharm.*, 96 (1924), No. 10, pp. 721-745, figs. 5).—A popular discussion relating to the history, early practices, introduction into the East Indies, chemistry, methods of manufacture, utilization, etc., of rubber.

The Rubber Conference, Brussels, 1924 (*London: Rubber Growers' Assoc.*, 1924, pp. 218, figs. 14).—Herein are presented the proceedings of the International Rubber Conference held at Brussels in April, 1924.

DISEASES OF PLANTS

[Plant pathology work at the Michigan Station], G. H. COONS (*Michigan Sta. Rpt.* 1923, pp. 213-215).—Cooperating with H. J. Stafseth of the department of bacteriology, studies on the precipitins of fungi of the Sphaeropsidales group as a means for their identification were continued, but without success, owing to difficulties in their preparation and use. However, results obtained with allied fungi are said to indicate that serum reactions will differentiate fungi readily. Work of M. C. Carpenter with dyes is said to indicate their value as a means of differentiating related organisms.

Among the plant disease investigations reported upon, a brief account is given of work carried on to develop a strain of celery that is resistant to the disease known as yellows. Progenies from original selections are being tested as to quality and type.

In bean disease investigations, work was continued on testing bean hybrids for anthracnose resistance, in which several new strains were derived by crossing Red Kidney beans with Robust beans. Several resistant types are said to be under further investigation.

In a previous publication (*E. S. R.*, 48, p. 644) R. Nelson reported finding heavily straining bodies in the phloem of mosaic diseased plants, and he interpreted these to be protozoa, but according to the author subsequent investigations have failed to confirm this interpretation.

A brief summary is given of potato disease investigations, in which it is stated that interesting results have been obtained on the use of sulfur for scab control. In testing the relative value of spraying and dusting for controlling hopperburn and fungus diseases, a marked superiority was shown for the Bordeaux mixture spray.

Tests have been made of a number of fungicides for stinking smut control, and the new copper dust methods for seed treatment have proved satisfactory and are being used rather extensively over the State. Some evidence has been secured to show that certain hybrids of high yielding wheats are immune to stinking smut.

C. W. Bennett investigated mosaic diseases of raspberry. He has carried out extensive roguing tests for the control of this disease, and he has demonstrated the relation of aphids to disease dissemination.

The effect of lactic acid on spore production by *Colletotrichum lindemuthianum*, E. F. HOPKINS (*Phytopathology*, 12 (1922), No. 8, pp. 390-393, figs. 2).—In studies of cultures of *C. lindemuthianum* in which the H-ion concentration was varied, it was found that the growth in diameter in the most acid culture was seven-tenths of that of the largest colony in the series. Spore production appeared to increase with increase in H-ion concentration and with the accompanying decrease in the amount of growth.

Studies on Helminthosporium species found on cultivated barley in California. G. E. PAXTON (*Abs. in Phytopathology*, 12 (1922), No. 9, pp. 446, 447).—Studies are reported on *H. gramineum* and *H. sativum*, both of which are said to occur on barley.

The resistance of oat varieties to stem rust. W. W. MACKIE and R. F. ALLEN (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 7, pp. 705-720, pls. 2, fig. 1).—The results are given of a test of 217 varieties of oats grown in the greenhouse and in the field, in 1920, after being inoculated with oat stem rust collected at Berkeley, Calif., and of varieties of oats inoculated with collections of oat stem rust secured from nine oat-growing districts in other parts of the State. In general, the resistant varieties in the first experiment proved resistant to the rust from all the different sources, and the susceptible varieties were susceptible to all.

A Helminthosporium root rot of wheat in Idaho. J. M. RAEDER (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 447).—A serious root rot of wheat was reported from Idaho, in which the plants were stunted and lighter in color. In some spots many of the plants were killed, and the remaining ones were stunted and produced shriveled grain. The species of fungus responsible for the root rot was not determined.

The relation of temperature and hydrogen-ion concentration to urediniospore germination of biologic forms of stem rust of wheat. C. R. HURSH (*Phytopathology*, 12 (1922), No. 8, pp. 353-361, figs. 7).—A report is given of studies made to determine whether physiological differences could be demonstrated for biological forms of stem rust of wheat without the aid of differential hosts.

The experiments were limited to the effect of H-ion concentration and temperature on the germination of the urediniospores of Biologic Forms XI and XXVII of *Puccinia graminis*. A considerable difference in germination in the two forms in response to temperature and H-ion concentration was observed. The form more limited in its host range was also more restricted in tolerance of extremes of H-ion concentration and temperature. It is believed that at least some biologic forms possess individual physiological characteristics that are demonstrable by physical and chemical studies, and that these may be sufficient to establish them as definite taxonomic entities.

The rosette disease of wheat and its control. A. G. JOHNSON, H. H. MCKINNEY, R. W. WEBB, and C. E. LEIGHTY (*U. S. Dept. Agr., Farmers' Bul.* 1414 (1924), pp. II+10, figs. 5).—A popular description is given of the rosette disease of wheat as it occurs in certain localities in Illinois and Indiana, and suggestions are given for its control. As certain varieties of wheat of good quality have been found not subject to this disease their planting is recommended.

The action of Uspulun on seeds in germination [trans. title], S. CZARNOWSKI (*Rocz. Nauk Rolnicz.*, 11 (1924), No. 1, pp. 52-62).—Uspulun, principally mercury chlorophenol, for which much has been claimed as a disinfectant of seed grains, was tested at 0.5 per cent with a spring wheat. The results showed for the plantlets a diminution in size and weight in case of seeds sterilized in Uspulun. This is ascribed to a lower utilization of the seed reserves. Germinative energy (percentage of grains germinated in about 3 days) was less in the sterilized seeds. Germinative power (percentage of grains germinated in about 6 days) was not lessened by the treatment. Carbon dioxide production per 100 seeds during germination was less in case of the sterilized seeds, though greater during this period in comparison with the weight of roots and shoots. Washing the seeds with water in case of seeds

treated with Uspulun augmented the carbon dioxide production by sterilized seeds, but not the weight of rootlets nor shoots from such washed seeds.

Acromania, or "crazy-top," a growth disorder of cotton, O. F. COOK (*Jour. Agr. Research* [U. S.], 28 (1924), No. 8, pp. 803-828, pls. 15).—A description is given of an abnormal behavior of cotton which has been observed in Arizona. Both Egyptian-American and upland cottons are subject to this disordered growth, upland varieties perhaps more severely than Pima-Egyptian. The trouble is said to be characterized by an abnormal branching of the upper part of the plant, accompanied by sterility, vegetative branches taking place of fruiting ones.

The author compares this disorder with the symptoms of a number of other cotton diseases of unknown origin and suggests a possible relationship with some of the mosaic diseases.

The influence of soil temperature upon the development of flax wilt, L. R. JONES and W. B. TISDALE (*Phytopathology*, 12 (1922), No. 9, pp. 409-413, fig. 1).—In a previous publication (E. S. R., 38, p. 449) the critical low temperature for the development of *Fusarium lini* was placed at about 15° C. (59° F.). Later studies under better control confirmed this conclusion and showed that the maximum temperature was about 38°, with an optimum temperature for the fungus between 24 and 28°. Temperature curves for the optimum growth of flax and for the parasite closely coincide.

Field and other observations are said to indicate that flax wilt is severe during hot summers and less so in cool ones.

The distribution of this disease and similar ones of cabbage and tomato, as affected by temperature, is discussed.

On the occurrence of *Mycosphaerella* wilt of muskmelons in Japan, T. HEMMI (*Phytopathology*, 12 (1922), No. 8, pp. 394-397).—Attention is called to a wilt of muskmelons in Japan, the cause of which is considered to be *M. citrullina*. The same fungus is also reported to attack cucumbers and a variety of gourd.

A *Fusarium* bulb rot of onion and the relation of environment to its development, J. C. WALKER and E. C. TIMS (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 683-694, pls. 3, figs. 3).—A bulb disease of onions, which is said to be of increasing importance in the United States, is described. The authors have studied this disease in the middle western part of the country, where it appears to be caused by *F. cepae*. The cultural characters of the fungus and its temperature and moisture relations are described at length. Inoculations were readily secured through wounds in plants growing from sets in the greenhouse, although a much smaller percentage of infections was secured when the plants were not wounded. As high as 22 per cent infection was secured in plants grown out of doors, from sets and from seed, on previously inoculated soil. The most rapid development of the disease occurred at temperatures of from 28 to 32° C., and it did not develop at 12°. Variation in soil moisture was found to have little or no effect upon the progress of the disease after initial infection had taken place. The results of soil temperature experiments were found to coincide with the occurrence of the disease in the field. In Wisconsin, due to the cooler summers, the disease did not appear until after July 1. The most serious outbreaks of this bulb rot in the United States are reported to have been in the Walla Walla section of Washington and the Uncompahgre section of Colorado. It also occurs in the Valencian district of Spain. All three sections are said to be subject to extremely hot weather during the latter part of the onion-growing season.

In addition to attacking onions in the field, the organism brings about a storage disease which is most active at or above room temperature. At 30°

the tissues were said to decay and dry rapidly, while at 20° the decay was rapid but the tissues remained watery for a longer time. At 15° the decay was very slow, but premature sprouting of the bulb was evident. At 8° the rot was very slight, but the promotion of premature sprouting in inoculated bulbs is said to have been very marked.

An emended technical description of the fungus is given.

Stem and fruit blight of peppers caused by *Phytophthora capsici* sp. nov., L. H. LEONIAN (*Phytopathology*, 12 (1922), No. 9, pp. 401-408, figs. 2).—A description is given of a stem and fruit rot of chili peppers first observed at the New Mexico Experiment Station in 1918 and subsequently studied in detail. The cause of the disease is said to be *P. capsici* n. sp., a technical description of which is given.

Influence of the meteorological factors on potato disease and production in Colorado, H. G. MACMILLAN (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 445).—From a critical study of meteorological factors and potato production, the author believes that the temperature for at least six months prior to planting is reflected in the conditions of the crop and the yield. An estimate of the winter and spring temperatures showing whether they are above or below normal, it is thought, would be of great benefit to the farmer in preparing his seed potatoes. In years of high winter and spring temperatures whole seed should be planted.

The respiration of potato tubers in relation to the occurrence of blackheart, J. P. BENNETT and E. T. BARTHOLOMEW (*California Sta. Tech. Paper* 14 (1924), pp. 35, pls. 3, fig. 1).—In a previous publication (E. S. R., 35, p. 349) Bartholomew showed the artificial production of blackheart of potatoes when exposed for 15 to 20 hours to temperatures of from 38 to 40° C. with free access of air. Subsequent studies have been conducted on the gas exchange of tubers, and in the present paper the authors report on the relation of temperature, time, and oxygen supply to the production of blackheart. Several varieties of tubers were sealed in glass jars, with definite ratios of air to tubers. They were then subjected to temperatures of from 0 to 45° for varying times, and the effect was noted.

A definite relation was found between temperature, oxygen supply, and the period of exposure required to produce blackheart, and differences in the readiness with which different varieties could be injured by heating at high temperatures were largely eliminated when the tubers were heated while confined in jars with six volumes of air to one of tubers. When the tubers were confined in jars and heated to temperatures of from 20 to 30°, which were too low to cause injury with the tubers surrounded by normal air, differences in behavior appeared which corresponded to the differences exhibited by the different varieties when heated in normal air at from 35 to 40°. The differences in behavior at high temperatures were thought possibly to be due to differences in the permeability of the skins to oxygen.

As the temperature was lowered, longer periods of confinement in the jars were necessary to produce injury, until 5° was passed. At temperatures of 2.5 and 0° injury occurred more quickly than at 5°. Lowering the temperature was found to cause a decrease in the rate of respiration as indicated by the carbon dioxide output. Decreasing the temperature below 5° caused an increase in the rate of respiration, and the rate of respiration at 0° was nearly as high as at 10°. In all cases, oxygen was absorbed more rapidly than carbon dioxide was produced during the early part of the experiments, and the respiratory ratio at the lower temperatures was less than at the higher ones. At low temperatures injury to tubers did not occur until a considerable period had elapsed after the exhaustion of the oxygen from the atmosphere of the jar.

The maximum period of exposure to an atmosphere devoid of oxygen before injury occurred was 42 days at 5°. Injury did not occur at the lower temperatures until the approximate equivalent of the available free oxygen had been returned as carbon dioxide to the atmosphere of the jar. The rate of respiration before exhaustion of free oxygen was about twice as great as afterwards. The tubers evidently used the oxygen accumulated in the tissues, but with more difficulty than the free oxygen from the surrounding atmosphere. It is believed that the actual injury resulted when anaerobic conditions were brought about in the tissues, and this is attributed to processes initiated as a result of those conditions.

Tubers confined at 20° or higher invariably showed typical internal blackheart as originally described. Tubers injured at 15° or below usually showed internal and surface injury, and occasionally a diffuse injury throughout the tissues. The accumulation of carbon dioxide in the jars appeared to have no close relation to the production of blackheart. Tubers exposed to low temperatures until they became sweet appeared to be more easily injured by high temperatures than nonsweet tubers.

Potato blackleg with special reference to the etiological agent, H. M. JENNISON (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 444).—The author claims that at least four species of *Bacillus* have been described as the etiological agent of the blackleg disease of potatoes. As a result of his investigations it is thought that the cause should be referred to as *B. atrosepticus*, and that *B. phytophthorus*, *B. solanisaprus*, and *B. melanogenes* are identical with *B. atrosepticus*.

Corticium vagum as a factor in potato production, B. L. RICHARDS (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 444).—Several strains of *C. vagum* were found to produce severe and characteristic cankers on all underground parts of the potato. Field experiments showed that under conditions favorable for its pathogenic activity the fungus seriously reduced the number and size of the tubers, decreased the number of stems per hill, and greatly weakened the surviving vines. Under natural conditions, soil temperature was found to be the most important factor in determining loss to the crop.

The relation of air temperature to the mosaic disease of potatoes and other plants, J. JOHNSON (*Phytopathology*, 12 (1922), No. 9, pp. 438-440, fig. 1).—In a previous publication (*E. S. R.*, 50, p. 41) the author showed that the optimum and maximum temperatures for the mosaic disease of tobacco are from 28 to 30° and 36 to 37° C., respectively. Similar experiments have been conducted with the mosaic disease of other plants, including potatoes, tomatoes, soy beans, pea beans, and clover, special attention being given to the potato mosaic.

The optimum and maximum temperatures for potato mosaic were found to be considerably lower than those for tobacco mosaic. Potato plants and tubers infected with mosaic were kept for varying lengths of time at temperatures from 30 to 36° to determine whether such treatment would destroy the mosaic virus, and although exposures as long as 10 days at 36° failed to destroy the virus there was some indication that longer treatment might be effective without destroying the germination of the tuber.

Of the other mosaic diseases studied, all were found to respond to temperatures in a manner similar to tobacco and potato. Mosaic of tomato was most active at high temperatures, whereas clover mosaic appeared to be favored by low temperatures. Soy bean mosaic was inhibited at temperatures of from 26 to 28°, but the pea bean mosaic persisted at a considerably higher temperature.

Potato disease work, J. D. KOTILA (*Michigan Sta. Rpt.* 1923, p. 259).—A report is given of experiments to determine the efficiency of Bordeaux mixture and copper lime dust when applied to Green Mountain potato vines. The plats which received six applications of Bordeaux mixture during the season remained green much longer than those which received a like number of applications of copper lime dust. The plats treated with Bordeaux mixture also outyielded those which were dusted.

In another publication (E. S. R., 51, p. 148) unfavorable results were reported on the control of potato scab with applications of sulfur to the soil at the rate of 300 lbs. per acre. Larger applications were made, and the data obtained at harvest indicated that scab was not controlled by applications to the soil of inoculated sulfur at the rates of 400, 600, or 800 lbs. per acre. On the plats that received 1,200 and 1,600 lbs. of inoculated sulfur per acre there was a lower percentage of scab, but this reduction was counterbalanced by a higher percentage of sulfur injured tubers.

A Fusarium blight of spinach, C. W. HUNGERFORD (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 447).—A spinach disease attributed to a species of *Fusarium* belonging to the *Marteilla-Elegans* section is reported.

Destructive rust (*Puccinia subnitens*) on spinach in the Northwest, H. P. BARSS (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 446).—The author reports the occurrence of *P. subnitens* on spinach leaves submitted to the Oregon Experiment Station in 1922. The alternate host of this fungus in the region is said to be the salt or alkali grass, *Distichlis spicata*.

Relation of rainfall to the late blight or Phoma rot of the sugar-beet, B. L. RICHARDS (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 443).—An epidemic of late blight of sugar beets which occurred in Utah and Idaho in 1921 is thought to be closely correlated with abnormally low precipitation during the months of June and July.

The stem rot of sweet potatoes, R. F. POOLE (*New Jersey Stas. Bul.* 401 (1924), pp. 32, figs. 13).—The author reports that stem rot disease of sweet potatoes due to *Fusarium hyperoxysporium* and *F. batatis* has become of considerable economic importance, and that as yet no satisfactory soil treatment has been discovered. Control measures based on growing resistant varieties have been undertaken, and in the present publication the results are given of studies to determine the relative resistance of different strains and varieties on different soil types in the State.

Seed potatoes and soils in both hotbed and field were found important sources of infection, soils being the most important one. A considerable number of varieties of sweet potatoes were grown under different conditions and their adaptability determined. Based upon results of his investigations, the author suggests that on soils where the disease has not been observed and on very slightly infected soils any of the Jersey varieties found profitable may be successfully grown. On other infected soils, where loss due to stem rot does not exceed 15 per cent, certified seed of the more resistant strains of Jersey varieties are recommended. On severely infected soils it is suggested that the varieties White Yam, Triumph, and Red Brazil should be planted. On some of the more severely infected soils, especially on deep sandy ones, none of the varieties tested proved satisfactory, and in this case the author suggests the growing of other crops.

The spread of tomato wilt by infected seed, J. A. ELLIOTT and R. F. CRAWFORD (*Phytopathology*, 12 (1922), No. 9, pp. 428-434, pl. 1, figs. 2).—The authors offer evidence obtained by observation and carefully controlled experiments which is believed to indicate that tomato wilt due to *Fusarium lycoper-*

sici is seed borne. How long the fungus will remain viable in tomato seed remains to be determined.

Thielavia basicola on watermelon in Oregon, M. B. MCKAY (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 445).—Diseased watermelons studied at the Oregon Experiment Station showed the presence of a fungus which proved to be *T. basicola*.

A "plum pocket" on *Prunus subcordata* in Oregon, S. M. ZELLER (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 443).—The author reports infections by a species of *Exoascus* on wild plums in Oregon, the fungus differing from *E. pruni* and *E. communis*, which appear to be its nearest affinities.

Leaf scorch or mollisiose of the strawberry, R. E. STONE (*Phytopathology*, 12 (1922), No. 8, pp. 375-380, figs. 3).—A disease of strawberry plants due to *Mollisia earliana* is described. It is characterized by the appearance of strawberry leaves with irregular purple blotches of varying size. As the season advances the blotches enlarge, and as they increase in size they become gray or cinereous, with a purple border. When the blotches become dry the dark acervuli become prominent, scattered thickly over the surface.

A revised description is given of the fungus and its relation to *Marsonia potentillae*. The ascigerous stage is pointed out.

No control measures were determined by the author.

The Rhizoctonia brown rot and other fruit rots of strawberries, B. O. DODGE and N. E. STEVENS (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 643-648, pls. 3).—A description is given of a hard brown rot of strawberries that has been under observation by the authors since 1920. The disease is said to have become important in central Florida, and it is characterized by the fact that it regularly starts on the under side of the berry, advances slowly, and shows a definite line of demarcation between the brown decayed portion and the normal uninfected pulp. In addition the berry is often distorted or one-sided in shape, and particles of soil adhere to the affected area. The disease is said to be due to the fungus *R. solani*.

Notes are also given of other brown rots of strawberries that may be confused with the hard brown rot as follows: Tan rot due to *Peizizella lythri* (E. S. R., 36, p. 452; 48, p. 848), leather rot due to *Phytophthora* sp. (E. S. R., 52, p. 150), and brown rot caused by *Botrytis* sp. (E. S. R., 39, p. 543).

Distribution of *Tylenchus dipsaci* on wild strawberry in Oregon.—Preliminary report, M. B. MCKAY (*Abs. in Phytopathology*, 12 (1922), No. 9, pp. 445, 446).—The leaf and stem-infecting nematode (*T. dipsaci*) was found on wild strawberry plants in the summer of 1921 in several localities in Oregon.

A new species of *Schizonella*, M. O. PARTHASARATHY IYENGAR and M. J. NARASIMHAN (*Phytopathology*, 12 (1922), No. 9, pp. 435-438, figs. 4).—A description is given of *S. colemani* n. sp., which is said to cause witches'-broom on *Vitis quadrangularis* in India.

A new *Phomopsis* of citrus in California, H. S. FAWCETT (*Phytopathology*, 12 (1922), No. 9, pp. 419-424, figs. 2).—The author describes *P. californica* n. sp. and compares it with *P. citri*. The fungus was isolated from lemons, and in California it appears to be a weaker parasite than *P. citri* as reported in Florida and other regions where that species is found.

A *Phomopsis* in grape fruit from the Isle of Pines, W. I., with notes on *Diplodia natalensis*, W. T. HORNE (*Phytopathology*, 12 (1922), No. 9, pp. 414-418, pls. 2, fig. 1).—A description is given of *P. caribaea* n. sp. isolated from grapefruit from the Isle of Pines, and the fungus is discussed in connection with *P. citri* and *D. natalensis*, both of which cause a stem-end rot of citrus fruits.

Occurrence of *Thielaviopsis paradoxa* on the coconut palm in Florida, H. R. FULTON (*Phytopathology*, 12 (1922), No. 8, pp. 398, 399).—An examination of a diseased coconut trunk is said to have shown the presence of a fungus, the cultures of which agreed closely with the published descriptions of *T. paradoxa*.

Pathology of quaking aspen in Utah in relation to regulation, E. P. MEINECKE (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 446).—Quaking aspen in Utah is said to be subject to attack by *Fomes igniarius*. Wounds from fire are said to lead to infection commonly, and the elimination of fires and active control of other injurious factors are considered indispensable in the regulation of aspen stands.

The life history of *Rosellinia caryae* n. sp. causing a hickory canker and disease, L. BONAR (*Phytopathology*, 12 (1922), No. 8, pp. 381-385, figs. 3).—A description is given of a canker and disease found on young trees of shell-bark hickory (*Carya ovata*). The name *R. caryae* n. sp. is proposed for this fungus, the pycnidial stage of which belongs to the genus *Dothichiza*.

Notes on chemical injuries to the eastern white pine (*Pinus strobus*), W. H. SNELL and N. O. HOWARD (*Phytopathology*, 12 (1922), No. 8, pp. 362-368, pl. 1, figs. 2).—The authors describe a conspicuous reddening of the foliage of the white pine in eastern Massachusetts that is attributed to injury caused from acid fumes emanating from a brickkiln where coal was used as fuel. A number of other species of plants were affected in much the same manner.

Injury to white pines due to leaching of calcium chloride from barrels stored under trees is reported.

Observations on two poplar cankers in Ontario, E. H. MOSS (*Phytopathology*, 12 (1922), No. 9, pp. 425-427).—Notes are given on *Dothichiza populea* and *Cytospora chrysosperma*, both of which produce cankers on species of *Populus* in Ontario.

Lightning injury to *Hevea brasiliensis*, C. D. LA RUE (*Phytopathology*, 12 (1922), No. 8, pp. 386-389).—The author reports that trees of *H. brasiliensis* are frequently injured or killed by lightning. Both young and old trees may be affected. Splintering or shattering of the trunks or branches by lightning is said to be extremely rare in rubber trees.

Torula ligniperda: A *Hyphomycete* occurring in wood tissue, P. V. SIGGERS (*Phytopathology*, 12 (1922), No. 8, pp. 369-374, pl. 1).—The author reports that *T. ligniperda* has been found by various investigators in spruce, fir, oak, buckthorn, French briar, cypress, yellow poplar, maple, basswood, eastern hemlock, white ash, and red gum. Laboratory experiments have shown that it could be grown in cypress, white ash, yellow poplar, and cucumber trees. White ash logs heavily infected with the fungus showed a decrease in strength values.

A staining method for hyphae of wood-inhabiting fungi, E. E. HUBERT (*Phytopathology*, 12 (1922), No. 9, pp. 440, 441).—A method is described that has been successfully used in staining the hyaline hyphae of wood-rotting fungi, which in the unstained sections are ordinarily invisible under the microscope.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Rodent enemies of fruit and shade trees, J. SILVER (*Jour. Mammalogy*, 5 (1924), No. 3, pp. 165-173).—The author finds that 17 kinds of rodents may be specifically selected as potential enemies of fruit and shade trees, of which at least 5 may be considered to be really serious. These enemies may be divided into two classes, the bark eaters, of which there are 10 groups, and the seed eaters, of which there are 7.

Food habits of some winter bird visitants, I. N. GABRIELSON (*U. S. Dept. Agr. Bul. 1249 (1924), pp. 32, pls. 5*).—This bulletin reports upon investigations made of winter bird visitants, the food habits of several of which have not been previously published. The forms dealt with include the evening grosbeak (*Hesperiphona vespertina*), pine grosbeak (*Pinicola enucleator*), red crossbill (*Loxia curvirostra*), white-winged crossbill (*L. leucoptera*), hoary redpoll (*Acanthis hornemanni exilipes*), common redpoll (*A. linaria*), pine siskin (*Spinus pinus*), snow bunting (*Plectrophenax nivalis*), Lapland longspur (*Calcarius lapponicus*), Smith longspur (*C. pictus*), chestnut-collared longspur (*C. ornatus*), McCown longspur (*Rhynchophanes mccowni*), common pipit (*Anthus spinoletta rubescens*), and the Sprague pipit (*A. spraguei*). Of these, the pine and evening grosbeaks, redpolls, crossbills, and pine siskins are primarily birds of the wooded country, and seeds or buds of shrubs and trees form a considerable part of their diet. The snow bunting and longspurs are prairie-feeding species, and the seeds of various grasses and weeds form the bulk of their diet, while the pipits are insectivorous.

The English sparrow in western Washington, L. K. COUCH (*Western Washington Sta. Bimo. Bul., 12 (1924), No. 4, pp. 93, 94*).—A brief practical account of this sparrow, complaints against which in Washington have been received mainly from poultrymen and warehousemen.

Report of the section of entomology [of the Michigan Station], R. H. PETTIT (*Michigan Sta. Rpt. 1923, pp. 219-235, figs. 14*).—The summer of 1922 in Michigan was notable for the prevalence of the pea aphid. At a conference of entomologists and others interested in pea culture, held at Chicago in November, at which representatives from 10 States extending from New York and Maryland to California were present, it was agreed "that the cost per acre of large spraying operations is from \$3.50 to \$6.00 per application, including cost of material, labor, and depreciation of machinery, and aphid control will require under ordinary conditions at least two applications. The expense of dusting, based on present data and costs of materials, is slightly higher than that of spraying. The speed with which dusting may be done, however, is much greater, and this counts in cases of emergency."

The receipt on May 9, 1923, of special report No. 25 of the U. S. D. A. Bureau of Entomology Insect Pest Survey, reporting the presence of the pea aphid seriously injuring alfalfa from Kansas City to Boonville, Mo., led the author to compute, by means of the number of isophanes intervening between Kansas City and Grand Rapids, about when its appearance might be expected in Michigan should the aphid appear at all in numbers. It is pointed out that the rate of progress of the season appeared to justify his conclusion, namely, that it might be expected in the latitude of Grand Rapids and Kent City, where canning peas are grown, on about Decoration Day. The numbers of this pest were to a large extent reduced by the presence of a large number of ladybird beetles, two hymenopterous parasites, one of which was *Lysiphlebus* sp., and the fungus disease due to *Empusa aphidis*.

The most serious outbreak of the grape berry moth that has ever occurred in Michigan took place in the summer of 1922. The spray generally used consisted of arsenate of lead 1.5 lbs. to a barrel of Bordeaux with 1 lb. of resin fish oil soap added for a sticker, applied under high pressure at the rate of 300 gal. to the acre. An investigation of the methods used clearly showed the superiority of the follow-up method over a spray put on with a boom rig, and also indicated the superiority of four sprays, the loss in some vineyards so sprayed being less than 7 per cent.

A successful campaign was conducted against chinch bugs during a severe attack on corn in the southern counties of the State in 1922. An effective type of barrier under Michigan conditions consists of a line of tar along which post holes are dug 20 to 30 ft. apart and 12 in. deep, in which are placed 2 in. of hydrated lime. A dust mulch barrier is also described.

Paradichlorobenzene is coming into quite general use in the State against the peach borer. By its use, worming peach trees, with its very real hazard of carrying the infection of crown gall from tree to tree on the tools employed, can be avoided. The author finds this consideration alone sufficient to recommend the use of the chemical treatment very strongly, since he has seen crown gall spread from a few trees to an entire peach orchard merely by using an unsterilized knife on tree after tree in removing the larvae from about the crown:

After a search covering a period of 25 years, the author has at last found a dressing which serves fairly well as a repellent against the flat-headed borer, and which will undoubtedly prove as effective against other borers as well, the formula being common laundry soap 50 lbs., water 3 gal., flake naphthalene 25 lbs., and flour 2 lbs. This mixture has been made in the winter and stored in air-tight drums. It should be applied with a brush after warming and thinning slightly to the consistency of heavy cream. Applications were made during the three weeks beginning June 1, and in no case has any injury to the trees resulted. Few flat-headed borers have been found in trees so protected, although they were abundant in check trees and in some cases had done very serious injury to young trees in the same orchards previous to the application.

Other insects briefly considered include grasshoppers, the bean weevil, the three-banded leafhopper, the potato leafhopper in alfalfa, termites, the codling moth, the grape-blossom midge, the peach thrips (*Thrips tritici*), the spruce cone worm (*Dioryctria reniculella*), the birch leaf skeletonizer (*Bucculatrix canadensisella*), and the rosy aphid.

Fifty-fourth annual report of the Entomological Society of Ontario, 1923 (*Ent. Soc. Ontario Ann. Rpt.*, 54 (1923), pp. 104, figs. 11).—Among the papers presented at the annual meeting of this association, held at Ottawa in November, 1923, are the following: The Early Days of the Entomological Society of Ontario, by C. J. S. Bethune; The Rose Curculio in Manitoba, with Notes on Other Insects Affecting Roses, by H. A. Robertson; Two Problems in Natural Control, by N. Criddle; The Present Status and Distribution of the Apple and Thorn Skeletonizer (*Hemerophila pariana* Clerck, Lepid.), by M. D. Leonard; Taxonomic and Synonymic Tendencies with Especial Reference to Diptera, by C. H. Curran; Miscellaneous Notes on Grape Leaf Hopper Control, by W. A. Ross; The New Regulations under the Destructive Insect and Pest Act, by L. S. McLaine; The Value of Natural Enemies of Injurious Insects, by A. F. Burgess; The Onion Maggot in Alberta, by H. E. Gray; The Onion Maggot in the Ottawa District, by G. H. Hammond; Onion Maggot Studies in the District of Montreal, Quebec, 1923, by T. Armstrong; Notes on the Life History of the Clover Leaf Weevil (*Hypera punctata*), by H. F. Hudson and A. A. Wood; Winds and Gipsy-Moth Spread, by E. P. Felt; Will the Gipsy-Moth Cross the International Boundary? by H. L. McIntyre; *Rhagoletis pomonella* and Two Allied Species (Trypanidae, Diptera), by C. H. Curran; Insects of the Season, by W. A. Ross and L. Caesar; A Study of the Pupal Case of *Prionoxystus macmurtrei*, by C. B. Hutchings; Notes on Lice with Special Reference to the Chicken Louse (*Lipeurus heterographus*), by A. R. Wickware; Insects of the Season in Quebec in 1923, by G. Maheux; The Spread and Degree of Infestation of the European Corn

Borer in Ontario in 1923, by W. N. Keenan; The Status of the Control Practice for the European Corn Borer in Ontario (A Progress Report), by H. G. Crawford; Studies in the Life-History, Bionomics, and Control of the Cabbage Worm in Ontario, by C. R. Twinn; and The Entomological Record, 1923, by Criddle, Curran, Viereck, and Buckell.

Applied entomology of Palestine, being a report to the Palestine Government, P. A. BUXTON (*Bul. Ent. Research*, 14 (1924), No. 3, pp. 289-340, pls. 5, figs. 10).—The report here presented is based upon observations made by the author while serving as medical entomologist to the Palestine Government from May, 1921, to August, 1923.

Notes on insect pests in Samoa, O. H. SWEZEY (*Hawaii. Planters' Rec.*, 28 (1924), No. 2, pp. 214-219; *abs. in Rev. Appl. Ent.*, 12 (1924), Ser. A, No. 6, p. 272).—The author presents an annotated list of insect pests observed in Samoa during September, 1923, arranged under the crops attacked, namely, sugar cane, coconut, banana, papaya, taro, and cucurbits.

The introduction into Hawaii of insects that attack lantana, R. C. L. PERKINS and O. H. SWEZEY (*Hawaii. Sugar Planters' Sta., Ent. Ser. Bul.* 16 (1924), pp. 82, pl. 1, figs. 7).—This bulletin gives an account of work conducted by Perkins and A. Koebele. In the main part (pp. 1-49), Perkins deals with the introduction of lantana insects and includes letters which passed between himself and Koebele during the progress of the work. Appendix A, which follows, is a List of Insects Observed in Connection with Lantana in Mexico, by R. C. L. Perkins (pp. 50-53); Appendix B, a Report on Enemies of *Lantana camara* in Mexico, and Their Introduction into the Hawaiian Islands, by A. Koebele (pp. 54-71), including brief accounts of insects affecting the flowers, seeds, flower stalk, leaves, stem, roots, and the branches; and in Appendix C, the Present Status of Lantana and Its Introduced Insect Enemies is dealt with, by O. H. Swezey (pp. 72-82). The insects considered by Swezey include the lantana butterflies *Thecla echion* L. and *T. bazochi* Gd. (*agra* Hew.), the lantana leaf bug *Teleonemia lantanae* Dis., the tortricid moth *Crociosema lantana* Busck, the plume moth *Platyptilia pusillidactyla* (Wlk.) (*lantana* Busck), the leaf miner *Cremastobombycia lantanella* Busck, the stem-gall fly *Eutreta xanthochaeta* Ald., and the seed fly *Agromyza lantanae* Frogg.

An apparatus for testing the toxic values of contact insecticides under controlled conditions, F. TATTERSFIELD and H. M. MORRIS (*Bul. Ent. Research*, 14 (1924), No. 3, pp. 223-234, pls. 2, figs. 2).—The apparatus constructed by the authors at the Rothamsted Experimental Station for the purpose of comparing quantitatively the lethal properties of contact insecticides, here described in detail, is so arranged that successive batches of insects are sprayed under conditions as similar as possible in order that the results may be directly comparable. The apparatus consists of a glass jar in the lid of which an atomizer is fixed. By means of compressed air at known pressure the atomizer throws a constant quantity of fine spray upon insects placed in a dish inside the jar.

Fumigation with liquid hydrocyanic acid: A comparison of costs, A. A. RAMSAY (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 6, pp. 439, 440).—In a comparison made of the relative costs of fumigating by the liquid and the departmental or pot methods, it was found that the liquid treatment was from 2.75 to 5 times as expensive as the departmental method.

The Egyptian cotton seed bug (*Oxycarenus hyalinipennis* Costa.): Its bionomics, damage, and suggestions for remedial measures, T. W. KIRKPATRICK (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 35 (1923), pp. [VIII]+106, pls. 28).—This is a detailed report of investigations of an im-

portant enemy of cotton, which appears to be abundant throughout Lower and Middle Egypt, as far south as Minya, and also abundant in the cotton-growing districts of the Sudan. It is said that nearly 97 per cent of the Egyptian cotton is grown in areas where the pest is abundant. A list is given of 17 plants upon which the species has been found to breed in Egypt, the most important of which are cotton, okra, and til. The pest is said to be immune to either parasites or predatory enemies. The elimination of places for hibernation is the most important method of control. The paper includes a bibliography of 44 titles.

A new psyllid injurious to fig trees, F. LAING (*Bul. Ent. Research*, 14 (1924), No. 3, p. 247, fig. 1).—Under the name *Trioxa burtoni* n. sp., the author describes a psyllid which is a source of injury through its forming galls on the leaves of *Ficus carica* in Palestine.

Fumigation checks aphids, R. W. KELLY (*Citrus Indus.*, 5 (1924), No. 6, pp. 8, 9, 32, figs. 3).—Fumigation experiments with calcium cyanide at Valrico, Fla., against aphids on citrus have led to the recommendation of a minimum period of three minutes for all sizes of tents. The amount of dust to be applied varies with the size of the tent, one 3 ft. in height being effectively rid of aphids with three puffs of a hand duster, a 5-ft. tent with five puffs, etc. The work was conducted with a mixture of calcium cyanide 75 per cent and dusting sulfur 25 per cent, which has been placed upon the market under the name of Citrus Dust. Preliminary observations have shown that open air dusting kills a substantial portion of the aphids but not an economical portion. It was found that the percentage of kill depends more on the dosage than on the time.

Control of the resistant black scale, R. S. WOGLUM and J. R. LA FOLLETTE (*Calif. Citrogr.*, 9 (1924), No. 10, pp. 376, 386, 387, 394, fig. 1).—While fumigation is considered by the authors the most satisfactory insecticide known for the black scale in most parts of southern California, a single fumigation has failed to control the resistant black scale over thousands of acres in eastern Los Angeles County. The authors' investigations indicate that a fumigation after the scale is all hatched, followed by a spraying with either of two miscible oils at from 1 to 1.5 per cent strength with 2 per cent liquid lime sulfur or its equivalent in dry, and from 2 to 3 lbs. of casein spreader between September and January is the preferred combination for resistant black scale in severe infestation on oranges when viewed from the standpoint of scale kill, injury, and cost. This combination also effectively controls the red spider. It has further been observed that the scale on small or moderate sized lemon trees can be successfully controlled by two thorough sprayings of properly mixed oil-lime sulfur combinations. The use of sprays containing lime sulfur during hot summer weather is attended with considerable risk of injury, and for this reason is not recommended.

The apple trumpet leafminer (*Tischeria malifoliella* Clem.), E. W. DUNNAM (*Iowa Sta. Bul.* 220 (1924), pp. 51-70, figs. 25).—This is a report of studies of *T. malifoliella* conducted in Iowa, particularly in 1922. While not previously recorded from the State, it is thought to have been present there for many years. Although its distribution is transcontinental, it is more injurious throughout the eastern portion of the United States. The author found three complete generations of the insect to occur at Ames, Iowa, in 1922, which is thought to represent the usual number for that section. The winter is passed in the full-grown larval stage in the mines in the fallen leaves, the overwintering larvae pupating in March and early April and transforming into moths in May. The average length of the life cycle is 35.32 days during July

and August. Technical descriptions are given of the several stages of the species.

In breeding cages at Ames, during the summer of 1922, the author secured the following parasites, some of which are thought to be secondary: *Kleidotoma* sp., *Closterocerus tricinatus* Ashm., *Pseudiglyphomyia nigrovariegata* Gir., *Apanteles ornigis* Weed, *Cirrospilus flavicinctus* Ril., *Pleurotropis* sp., *Horismenus fraternus* Fitch, *Eupelmus allynii* French, *Sympiesis massasoit* Cwfd., and *S. bimaculata* Cwfd. Spraying for the purpose of killing the larvae and pupae in their mines and to destroy the eggs and kill the young larvae as they start to enter the leaf, was commenced on July 15 and continued until the eggs were deposited for the last generation. In the experiments, in which lead arsenate was applied at rates of from 1 to 2 lbs. to 50 gal. of water and nicotine sulfate at from 1 to 1.75 pints to 100 gal. of water and soap on July 21, the best results were obtained from the nicotine sulfate used at the rate of 1 pint to 100 gal. of water, this acting as an ovicide. Stronger solutions proved injurious to the foliage of the trees. On August 15 the applications were repeated and similar results obtained.

The paper includes a list of 58 references to the literature.

Venomous caterpillars and the urticarial affections produced, G. LAPIE (*Les Chenilles Venimeuses et les Accidents Éruciques*. Paris: Libr. Sci. Nat., 1923, pp. 191, pls. 4).—The first part of this work (pp. 7–70) deals with venomous caterpillars; the second part (pp. 71–114) with the urticarial affections caused; the third part (pp. 115–129) with immunity, prophylaxis, and therapeutics; and the fourth part (pp. 131–142) with venomous caterpillars in medicinal material. Reports of observations are appended which deal with dermatoses caused by the oak processionary (pp. 145–154), dermatoses caused by the pine processionary (pp. 154–162), dermatoses caused by *Bombyx rubi* (pp. 162, 163), affections caused by the brown-tail moth (pp. 163–168), affections of the eyes (pp. 168, 169), affections caused by an undetermined exotic caterpillar (pp. 170, 171), and affections caused at Cayenne, French Guiana, by moths of the genus *Hylesia* (pp. 172–175). A bibliography of 11 pages is included.

Batrachetra arenosella Walk. (Cosmopterygidae) in relation to the nutfall of coconuts, G. H. CORBETT and B. A. R. GATER (*Malayan Agr. Jour.*, 12 (1924), No. 5, pp. 115–122, pls. 2).—This lepidopterous pest, first noticed in Malaya in the early part of 1922 and since found in the majority of the States in the peninsula, is a source of serious injury to the flowers of the unopened coconut spike. Eggs are deposited on the spathe, and the larvae bore into the spike, its life history being completed in about 16 days. In certain districts of Malaya an average of 65 per cent of the female flowers have been injured.

As a result of control work, the injury in one section was reduced from 56 to 10 per cent. The yield of unattacked nuts was only 1 per cent more than the yield from attacked nuts after the twelfth week. The direct injury by this pest is said to be negligible.

On zoophilism with Anopheles.—A review, L. O. HOWARD (*Jour. Parasitol.*, 10 (1924), No. 4, pp. 191–198).—This is a review of the protection to man from *Anopheles* afforded by the presence of domestic animals, in connection with a list of 21 references to the literature.

Remarks on a mermithid found parasitic in the adult mosquito (*Aedes vexans* Meigen) in British Columbia, G. STEINER (*Canad. Ent.*, 56 (1924), No. 7, pp. 161–164, figs. 7).—Under the name *Paramermis canadensis*, the author describes a new mermithid which parasitized 80 per cent of the males and females of *A. vexans* at Mission City in 1920 and 20 per cent in 1921.

From one to six nemas were found in the abdomen of each parasitized mosquito, the usual number being two. No parasitized mosquito was found with well-developed ovaries.

Ox warble flies, R. S. MACDOUGALL (*Scot. Jour. Agr.*, 7 (1924), No. 1, pp. 61-72).—This is a report upon a mass experiment made on a county-wide scale, in cooperation with farmers and stock owners in East Lothian and a part of Berwickshire and Midlothian, to test the value of tobacco powder and lime dressing for the destruction of *Hypoderma* larvae in the skin of infested cattle, to test derris and Lethol, to reduce the number of flies in the next season by mass destruction of the larvae, and to discover whether the mass observations would reveal new points in the life history or distribution of *Hypoderma*. The details of the work are reported largely in tabular form.

The tobacco powder and lime dressing resulted in the destruction of 2,916 of 3,572 larvae, or 82 per cent of the warbles dressed; the use of derris, 1 oz. to 1 qt. of water, in the destruction of 378 of 440 or 86 per cent and 1 oz. to 1 pt. of water in the destruction of 581 of 614 larvae, or 94 per cent; and the use of Lethol (a preparation of tetrachlorethane) in water in the proportion of 1:50 in the destruction of 9 of 22 warbles dressed, 1:25 in the destruction of 66 out of 88 dressed, 1:10 in the destruction of 43 of 48 dressed, and Lethol nicotine in the destruction of 149 of 211 warbles dressed.

A new hispid beetle injurious to oil palms in Brazil, S. MAULIK (*Bul. Ent. Research*, 14 (1924), No. 3, pp. 245, 246, fig. 1).—Under the name *Cephalolia claeidis* n. sp., the author describes a hispid beetle the larva of which is a serious leaf-miner of oil palms in Bahia, Brazil, and generally attacks the unopened buds. The adult is also a source of injury through feeding upon the leaves.

Effective use of hydrocyanic-acid gas in the protection of chick-peas (*Cicer arietinum*) warehoused in 240-pound sacks, E. A. BACK and R. T. COTTON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 649-660, pl. 1, fig. 1).—This is a report of investigations based upon studies conducted during the fumigation of 137,000 sacks (weighing 240 lbs. each) of chick-peas, in six warehouses in New Orleans.

The authors found that the infestation by *Bruchus quadrimaculatus*, *Rhizopertha dominica*, the tobacco beetle, and the Indian meal moth could be brought under very satisfactory control by fumigation with hydrocyanic acid gas, as a result of the thorough penetration of the gas throughout the bulk of the sacks whether these were stacked four or five deep, as chick-peas are ordinarily warehoused, or in piles, the tiers of which were often 18 sacks high. Infestations of the rice weevil and the Angoumois grain-moth were not satisfactorily controlled by one fumigation, though many were killed. Since *B. quadrimaculatus* is the primary pest of chick-peas, fumigation with hydrocyanic acid gas, when generated by the use of 2.5 lbs. of sodium cyanide (98 to 99 per cent pure) per 1,000 cu. ft. of space, was shown to be a dependable method of protecting chick-peas in storage. Fumigation with hydrocyanic acid gas has now become the standard control measure in commercial establishments handling this food.

Laws, rules, and regulations: Apiary inspection law (*Kans. Ent. Comm. Circ.* 4, rev. (1924), p. 8).—This is a compilation of laws, rules, and regulations.

A biological study of *Aphelinus mali* Hald., a parasite of the woolly apple aphid, *Eriosoma lanigera* Hausm., A. F. LUNDIE (*New York Cornell Sta. Mem.* 79 (1924), pp. 3-27, figs. 7).—This native American parasite of the

woolly aphid, first described by Haldeman in 1847, has become an important enemy of aphids, having been recorded from the woolly apple aphid, *Glyphina eragrostidis*, the cabbage aphid, *Pemphigus fraxinifolii*, *Aphis monardae*, *Siphonophora rosae floridae*, *A. sacchari*, *Tetraneura colophoidea*, *Toxoptera graminum*, *A. setariae*, *Colopha eragrostidis*, *Macrosiphum rosae*, *Myzus mahaleb*, *A. mali*, and an aphid on *Panicum* sp. The species is widely distributed in North America and has been reported as occurring in Java. It has been successfully introduced into France, Italy, Australia, New Zealand, Peru, Uruguay, and South Africa.

The methods used by the author in rearing it at Ithaca, N. Y., are described. The egg production of six females observed varied from 48 to 140, with an average of 96. The studies show the life cycle to vary from 19 to 43 days, with a marked tendency to increase in length as colder weather sets in. Of the 188 parasites reared, 149 showed a life cycle of from 20 to 29 days, the variation being as much as 13 days in individuals reared in the same cage, and thus under the same conditions of temperature and moisture. During the period from May 5 to October 12 there were at least six full generations and a partial seventh. The parasite hibernates as a full-grown larva in the hardened "shell," or body wall, of its host. But one other species was obtained by the author from the woolly aphid, which was identified by A. B. Gahan as *Asaphes americana*.

A brief report of the successful shipment and the establishment of this parasite in South Africa is included, as is a bibliography of 27 titles.

The polyembryonic development of *Platygaster vernalis*, R. W. LEIBY and C. C. HILL (*Jour. Agr. Research* (U. S.) 28 (1924), No. 8, pp. 829-840, pls. 8).—This is a report of studies of a parasite of the Hessian fly, carried on in continuation of those previously noted (E. S. R., 50, p. 158).

P. vernalis develops polyembryonically in the midintestine of the larva of the Hessian fly, one egg giving rise eventually to approximately eight individuals. There is but one generation annually.

"The adult parasites emerge from their cocoons in spring and almost immediately oviposit in the eggs of the host. By the first of June the embryos are fully formed in a well-grown host larva. The larvae feed upon the host during June and July, and then transform to pupae, which in turn become adults in August. A single egg is deposited by the parasite at each oviposition, and in such a manner that the egg always becomes lodged in the host's midintestine, where development to the larval stage is completed. Development begins immediately whether the egg is fertilized or unfertilized. If more than one egg is deposited in the same host by different females, one of the eggs may become aborted.

"In the course of maturation 2 polar bodies are formed, which become the 2 original paranuclear masses. The matured oöcyte or cleavage nucleus becomes the progenitor of the embryos. Four divisions of either the conjugated or parthenogenetic cleavage nucleus result in the production of 12 to 16 embryonic nuclei, each of which apparently gives rise to a germ. The germs develop in the central part of the parasite body and are encompassed by the trophamnion containing paranuclear masses. Some of the germs divide once, at the time they are composed of 8 nuclei, to form 2 daughter germs. A further division of the daughter germs apparently results in the production of pseudogerms.

"The group of germs comprising a parasite body is known as a polygerm. Each normal germ passes through the blastula and late embryonic stages, and finally becomes a primary larva. During the course of this development the

parasite body increases in size and remains intact in the midintestine of the host. When the primary larvae are formed they rupture the thin trophamniotic membrane and begin to feed upon the contents of the host's midintestine. Later the midintestine is ruptured, whereupon the secondary or mature larvae devour the entire contents of the host, leaving only the cuticula.

"Each larva constructs a cocoon in which it transforms to a pupa and later an adult parasite. The cluster of cocoons is surrounded by the cuticula of the host, and is further protected during the winter by the host's puparium. The adults of a brood are usually of the same sex. It is believed that the occasional mixed broods originate from a fertilized and an unfertilized egg deposited in the same host egg."

A list is given of nine references to the literature cited.

Report on a small collection of parasitic Hymenoptera from Java and Sumatra. A. B. GAHAN (*Treubia [Batavia]*, 3 (1922), No. 1, pp. 47-52).—In this contribution from the U. S. D. A. Bureau of Entomology six species are described as new and new host records given for four other species, to wit, *Asymplesiella india* Gir., reared from the larva of *Gracilaria theivora* Wlshm.; *Diaulomella javensis* n. sp. from a mixed lot of caterpillars of *Glacilaria* and *Laspeyresia*; *Mestocharella javensis* n. sp. from *G. theivora*; *Pleurotropis lividiscutum* n. sp. from cocoons of a braconid described by S. A. Rohwer as *Apanteles hidaridis* n. sp.; *Euplectrus* sp. from larvae of *Ophideres fullonica* L.; *Tetrastichus australasiae* n. sp. from the Australian cockroach; *Elasmus brevicornis* n. sp. from *Erionota thrax* L.; *Schedius podontiae* n. sp. from *Podontia affinis* Grond.; *Leurocerus ovivorus* Cwfd. from eggs of *Amathusia phidippus* L.; and *Telenomus latusulcus* Cwfd. bred from eggs of *Poecilocoris hardwicki* Westw.

Descriptions of Javanese Braconidae (Hym.) received from Mr. S. Leefmans. S. A. ROHWER (*Treubia [Batavia]*, 3 (1922), No. 1, pp. 53-55).—This contribution from the U. S. D. A. Bureau of Entomology contains descriptions of four species of Braconidae new to science, namely, *Apanteles homonae* from *Homona coffearia*; *A. hidaridis*, said to have been reared from the larva of *Hidari*; *A. parasae*, reared from the larva of *Parasa* sp.; and *Microbracon leefmansii* from *Gracilaria theivora*.

Is there an entomogenous fungus attacking the citrus rust mite in Florida? A. T. SPEARE and W. W. YOTHERS (*Science*, 60 (1924), No. 1541, pp. 41, 42).—This is a contribution from the U. S. D. A. Bureau of Entomology in which the authors call attention to the fact that shortly after the point of maximum infestation by the citrus rust mite (*Phyllocoptus oleivorus* Ashm.) is reached the mites disappear, so that by the middle or end of September it is nearly impossible to find a single mite present. It has been observed that most of the adult mites change color from a lemon yellow to a darker or orange yellow, and also become somewhat sluggish in their movements. Examination of dead mites shows that certain fungal filaments protrude from their bodies. The authors conclude that the circumstantial evidence already obtained makes it reasonably certain that an entomogenous fungus is responsible for this disappearance.

Capillaria columbae (Rud.) from the chicken and turkey. H. W. GRAYBILL (*Jour. Parasitol.*, 10 (1924), No. 4, pp. 205-207, pl. 1).—The author presents a detailed description of *C. columbae*, described by Rudolphi in 1819 under the name *Trichosoma columbae* as parasitic in the large and small intestines of the domestic pigeon and certain other columbines, from Princeton, N. J., and Washington, D. C.

FOODS—HUMAN NUTRITION

Basal metabolism in health and disease, E. F. DuBois (*Philadelphia: Lea & Febiger, 1924, pp. VIII+17-372, pl. 1, figs. 77*).—This monograph has been written for physicians and surgeons, medical students, and dietitians rather than for research workers or physiologists. The underlying principles of respiratory metabolism and its measurement and the accepted standards of normal metabolism are discussed in part 1 on metabolism in health. Part 2, on metabolism in disease, deals with basal metabolism in undernutrition; overnutrition; diabetes; diseases of the thyroid, blood, heart, kidneys, and nervous system; the influence of adrenal, pituitary, and sex glands and of fever on basal metabolism; water metabolism; and the effect of drugs on basal metabolism. Many references to the original literature, particularly recent publications, are given as footnotes.

Review of the literature for 1923 on infant feeding, R. D. MOFFETT (*Amer. Jour. Diseases Children, 27 (1924), No. 6. pp. 618-632*).—This review of the literature of 1923 on infant feeding is classified under the following topics: Breast feeding, artificial feeding, butter flour mixtures, acidified milk, goat's milk, thick cereal feeding, metabolism studies on infant growth, antiscorbutic capacity of different food substances, and other types of food used in infant feeding. A list of 49 references to the literature is given as footnotes.

A comparison of the metabolism of some mineral constituents of cow's milk and of breast milk in the same infant.—II, **Chloride metabolism**, C. C. WANG and L. H. DAVIS (*Amer. Jour. Diseases Children, 27 (1924), No. 6, pp. 569-577*).—This is a report of chloride metabolism experiments conducted at the same time and on the same subjects as the calcium studies previously noted (*E. S. R., 51, p. 664*).

A change of diet from breast milk to cow's milk was invariably followed by an increase in the chloride excretion in both feces and urine, the increase being attributed at least in part to the increased chloride intake of cow's milk. The average values obtained with cow's milk and breast milk were as follows: Intake, 1.4817 gm. and 0.4441 gm. per day, respectively; excretion in feces, 0.1128 and 0.0576; and excretion in urine, 1.0988 and 0.3298 gm., respectively.

The absolute utilization of chlorides was 1.3691 gm. for cow's milk and 0.3847 gm. for breast milk per day, and the percentage utilization 92.2 and 87.4 per cent, respectively. The chloride retention varied to a marked extent with the different subjects. The average retention for cow's milk was 0.2710 gm. or 18.9 per cent, and for breast milk 0.0886 gm. or 19.2 per cent. With increasing age there was a decrease in the actual amount of chloride retained from cow's milk but not from breast milk. The change in milk had no appreciable effect on the chloride content of the blood, which averaged 618.1 mg. per 100 cc. of plasma for cow's milk and 627.7 mg. for breast milk.

Studies in growth.—I, **Growth of normal children.** II, **Growth of premature infants**, F. B. TALBOT (*Amer. Jour. Diseases Children, 27 (1924), No. 6, pp. 541-555, figs. 26*).—In these studies the trend of growth of different parts of the body was determined by plotting a series of body surface measurements against age and drawing smoothed curves. The measurements for the normal children were taken from a previously reported investigation by Benedict and Talbot (*E. S. R., 45, p. 561*) and for premature children from a similar study of basal metabolism of prematurity by Talbot et al. The measurements selected were the circumference of the head, chest, and abdomen, and the

length of the trunk, legs, feet, and arms. The measurements for boys and girls were compiled separately.

The positions of the individual dots representing the measurements of a single child at a given age show that there is an expected growth for a normal child and that there is very little sexual differentiation. It is thought that the curves for normal children may be useful in the comparison of single observations with the normal to detect abnormality and in the determination of the effect of treatment on the growth of abnormal children.

A comparison of the curves for normal children and for those born prematurely shows that the uniformly smaller size of the premature infant at birth may persist for several months. Of the various measurements, the one agreeing most closely with the normal was the circumference of the head.

The nutritive value of proteins, H. H. MITCHELL (*Physiol. Rev.*, 4 (1924), No. 3, pp. 424-478).—In this extensive and critical review of the literature on the nutritive value of proteins, the author first discusses briefly the wastage of food protein in digestion and metabolism and the calculation of the net protein value of foods. The principal methods of investigating protein values are then subjected to a rigid critical examination.

The biological method for the analysis of a foodstuff, as formulated by McCollum and Davis (*E. S. R.*, 34, p. 368) and later modified by McCollum (*E. S. R.*, 47, p. 363), is criticized as being based upon a theory of nutrition that is known to be inadequate. "Until the nutritive requirements of the rat for the entire span of life and for all physiological functions are at least as well known as the requirements for maximum growth, this method for the biological analysis of a food as a source of protein can not be used with any great assurance of success unless proper control experiments are run at the same time. If the addition of an adequate amount of protein of good quality to a ration containing all known dietary factors in adequate amounts with the possible exception of protein, which is provided by the food under examination, gives a ration capable of supporting optimum nutrition, any inadequate nutrition evident from experiments on the original ration can logically be attributed to the inadequacy of its protein provided the food intakes in the two experiments are comparable."

The method of expressing numerically the growth-promoting value of proteins devised by Osborne, Mendel, et al. (*E. S. R.*, 36, p. 268) and modified later (*E. S. R.*, 40, p. 765) is considered to determine accurately which of two proteins is better utilized in growth, but to have a comparative rather than an absolute significance. "The gain in weight secured per gram of protein consumed, in other words, is not an absolute measure of the nutritive efficiency of the protein, since it is dependent upon the experimental conditions, particularly the size of the animal, the level of protein intake, and the amount of food consumed relative to body weight."

Of the methods involving a study of the nitrogen metabolism, the author's method of determining the biological value of proteins (*E. S. R.*, 51, p. 407) is considered to measure fairly accurately the fraction of absorbed nitrogen used by the body for all purposes, but not to give results of absolute value, characteristic for each protein and constant under all conditions. Evidence is reviewed showing the impossibility of determining the biological value of proteins for growth alone or milk production alone and the possibility of determining the value of proteins for maintenance alone.

With this critical discussion of methods as a background, the literature is reviewed on the nutritive value of proteins for maintenance, the nutritive value of proteins for maintenance and growth, the question as to whether the

biological values of proteins differ greatly for different animals, the relation of the amino acid constitution to the biological values of proteins, the supplementary relations among proteins, the biological value of proteins for milk production, and the physiological effects of protein.

A list of 150 references to the literature is appended.

A résumé of investigations of cottonseed flour as human food, I. G. MACY and J. OUTHOUSE (*Jour. Home Econ.*, 16 (1924), No. 11, pp. 630-635).—This is a brief review of the literature on the composition and nutritive value of cottonseed meal and on cottonseed meal poisoning in animals. A list of 25 literature references is appended.

Sulfur metabolism, H. B. LEWIS (*Physiol. Rev.*, 4 (1924), No. 3, pp. 394-423).—This review deals with the literature on the sulfur content of the diet, the action of the digestive secretions and the intestinal flora on sulfur compounds, forms of anabolized sulfur in the organism, the catabolism of cystine and related sulfur compounds, the sulfur excretion in the urine, the function of cystine in the animal organism, and sulfur metabolism in relation to disease. A list of 177 references to the literature is appended.

Intestinal autointoxication, W. C. ALVAREZ (*Physiol. Rev.*, 4 (1924), No. 3, pp. 352-393).—Using the classification of possible sources of intestinal poisoning, as given by Wells (*E. S. R.*, 45, p. 381), the author reviews the literature on the possible toxic action of the constituents of the digestive secretions, the products of normal digestion, the products of putrefaction and fermentation, and synthetic products of bacterial activity in the bowel.

Of particular interest is the discussion of the syndrome of constipation, and the evidence advanced that the characteristic symptoms accompanying it are not produced by chemical intoxication but by the mechanical distention and irritation of the rectum by the fecal masses. "It must be emphasized at this point that this explanation for the autointoxication syndrome applies only to those cases in which symptoms produced by constipation are relieved immediately after an evacuation of the bowels. Unfortunately most men who quote from the paper by Alvarez assume that he means that there is no such thing as chemical autointoxication, and that this mechanical explanation is all-sufficient. No such assumption was made or intended. It seems very probable that at times there is such a thing as an absorption of harmful toxins from the digestive tract, but that assumption can no longer be used to explain the production of symptoms in this particular circumscribed group of cases."

The impression given by the review is that the term intestinal autointoxication is too often used as "a convenient cloak for ignorance," and that many points must be given more exact study before the theory of intestinal autointoxication can be accepted unreservedly.

An extensive bibliography is appended.

Mammary secretion, V.—I, Further research on the threshold and effects of protein "excess." II, The quantitative relation of vitamin B to protein, G. A. HARTWELL (*Biochem. Jour.*, 18 (1924), No. 5, pp. 785-794, figs. 4).—In this continuation of the investigation previously noted (*E. S. R.*, 48, p. 861), the experiments in an earlier phase of the investigation (*E. S. R.*, 47, p. 858) were repeated without the use of yeast.

Female rats with litters of 6 each were fed diets consisting of 15 gm. of bread with varying amounts of casein, from 0.6 to 6 gm., daily. With all but the largest amount of protein, the growth of the litters was quite good and fairly constant up to about 12 days. At the time of weaning, the twenty-first day, the young rats on the lower amounts of protein weighed about 30 gm. each as compared with from 40 to 45 gm. for the controls. Beginning with the 0.9 gm., and increasing in severity with the larger amounts of protein, the

young showed spasms, with increasing mortality. On 6 gm. of casein none survived.

A second series of experiments was carried out similar to the first with the exception that tomato juice or marmite was used as a source of vitamin B, the amounts increasing with the amount of protein. For 1.2 gm. of casein, slight improvement was shown with 1.5 and entirely normal growth and development with 6 cc. of tomato juice. For 6 gm. of casein, the optimum amount of tomato juice was 25 cc. No better results were secured with larger amounts. Similarly, 0.6 cc. of marmite proved sufficient for 1.5 gm. of casein and 3 cc. for 6 gm. of casein.

It is concluded that there is a quantitative relation between protein and vitamin B.

The dietetic value of barley, malt, and malted liquors as determined by their vitamin content, H. W. SOUTHGATE (*Biochem. Jour.*, 18 (1924), No. 5, pp. 769-776, figs. 8).—Barley, kilned malt, and unclarified and clarified ale were tested for the presence of vitamins A, B, and C, with the following results:

A diet containing 50 per cent unhusked barley, representing about 7 gm. of barley per rat per day, failed to produce normal growth in the absence of other sources of vitamin A. An equal ration of malt failed to show preventive or curative properties. Similar negative results were obtained with unclarified and clarified beers in amounts up to 20 and 30 cc.

Negative results for vitamin C were obtained in the usual feeding tests conducted on guinea pigs, using 60 per cent of barley or malt as the sole source of vitamin C in a ration of oats and bran. Beer evaporated under reduced pressure had no protective or curative properties in 5-gm. doses.

The tests for vitamin B included experiments on rats and on pigeons. On a basal diet of caseinogen 24, starch 47.5, cane sugar 14.5, butterfat 10, and dry salt mixture 4 per cent, rats receiving 0.5 gm. of malt or a corresponding amount of barley did not grow normally. Those receiving 1 gm. of malt or 1.1 gm. of barley grew normally but did not reproduce, and those on 1.5 gm. of malt or 1.7 gm. of barley showed normal growth, with pregnancies. If anything, the malt proved slightly superior to the barley, indicating that at least no destruction of vitamin B had taken place during the malting. Pigeons which had developed polyneuritis on the same basal diet as that fed the rats were cured by 10-gm. doses of barley or malt. The minimum dose was not determined. Some growth, though not normal, was obtained with rats when ale, beer, and wort were used as the sole source of vitamin B in amounts increasing from 10 to 17 cc., representing from 3 to 4 gm. of the original malt. No growth was obtained with 5 gm. of wet brewers' grains. No difference was noted between clarified and nonclarified ale. It is suggested that the loss in vitamin B may be due to its absorption by the hops or by the yeast cells during fermentation.

New studies on the sensitization of the organism of the guinea pig to vitamin C deficiency [trans. title], G. MOURIQUAND, P. MICHEL, and M. BERHEIM (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 11, pp. 541-543).—The investigation previously noted (*E. S. R.*, 51, p. 767) has been extended by testing the sensitiveness to lack of vitamin C of guinea pigs which had been completely cured of scurvy 62 and 87 days previously. At the same time other guinea pigs of exactly the same weight, which had never shown symptoms of scurvy, were placed on the scorbutic diet. In the 62-day group the symptoms of sensitiveness of the bones appeared on the eighth day as compared with the seventeenth for the controls, but hemorrhages appeared at the same time, 19 days, in both lots, and the survival period was the same. In the other group

bone sensitiveness appeared on the thirteenth and fifteenth days and hemorrhages on the twenty-first and twentieth day, respectively, with the same survival period.

It is concluded that the sensitization is only transitory and due, as suggested in the previous paper, to long persistence of fine lesions in the bone marrow.

Studies on the effect of ultraviolet light on avitaminoses.—I, Experiments with pigeon beriberi [trans. title], J. KRÍŽENECKÝ (*Pflüger's Arch. Physiol.*, 204 (1924), No. 4, pp. 467-470).—In experiments conducted on 15 pigeons, evidence was obtained that ultraviolet light radiation has neither curative nor protective properties for avian polyneuritis.

Observations on the use of insulin, D. M. LYON (*Lancet [London]*, 1924, II, No. 4, pp. 158-162, figs. 2).—This is a general discussion of the administration of insulin, with particular emphasis on the distribution of the day's supply.

In observations on the effect of varying the interval between the administration of insulin and the taking of food, a time interval of 2 hours proved in general the most satisfactory, but in recommending this a word of caution is given against beginning the treatment with such a long interval in the case of emaciated subjects. In the distribution of the day's supply, it is recommended that not more than 12 hours be allowed to elapse between the evening and morning doses whether a third dose is given or not.

Insulin and the skin, E. F. MÜLLER and H. B. CORBITT (*Jour. Lab. and Clin. Med.*, 9 (1924), No. 9, pp. 608-617, figs. 3).—Experimental evidence is reported indicating that the injection of insulin into rabbits is more effective by the intradermal than the subcutaneous route. The difference appears to be in the prolongation of the effect of the insulin on the blood sugar when the injection is made intradermally. As an illustration, the changes in the blood sugar content of a normal rabbit 2, 4, and 6 hours after the intradermal injection of 1 unit of insulin per kilogram of body weight were -57.7, -49.7, and -8.1 per cent, respectively, while the corresponding changes after a similar subcutaneous injection were -46.7, +11.7, and +3.3 per cent, respectively. Some evidence was also obtained that the fatal dose for intradermal injection may be higher than for subcutaneous injection. These findings are thought to be of interest not only from the standpoint of the practical administration of insulin, but as suggesting that the skin plays an important rôle in specific biological processes.

Goitre, R. MCCARRISON (*Brit. Med. Jour.*, No. 3310 (1924), pp. 989-994).—In this lecture, delivered before the British Medical Association, the author discusses the possible factors upon which the prevention and cure of simple goiter depend. The chief factors are considered to be "(1) the general hygiene of the individual, and especially of the intestinal tract, and (2) the amount of iodine available for the needs of the thyroid gland and the organism generally." In some cases the condition of the intestine is normal, but there is a deficiency of iodine in the food and water. In others the iodine supply may be sufficient for the ordinary individual but insufficient for those suffering from gastrointestinal infection. A third possibility is that the iodine is relatively deficient in proportion to other constituents such as fat or calcium, and a fourth that both deficiency in iodine and intestinal infection may be factors.

Iodine deficiency in the dietary supplied by use of kelp, J. W. TURRENTINE (*Nation's Health*, 6 (1924), No. 7, pp. 449-451, 516).—The author suggests the use of dried kelp as the dietary source of iodine in goitrous communities. Analyses for iodine of 29 samples of giant kelp of the Pacific, *Macrocystis pyrifera*, which has been studied by the U. S. Department of Agriculture particularly from the standpoint of its utilization as a source of potash,

gave an average iodine content of 0.26 per cent, with minimum and maximum values of 0.17 and 0.41 per cent, respectively. Aside from iodine, the kelp contains on the dry basis 39 per cent of inorganic constituents consisting of calcium 4.96, magnesium 2.24, sodium 10.52, potassium 29.46, iron and aluminum oxides 0.43, chlorine 34.93, sulfur (calculated to SO_3) 7.92, CO_2 4.44, and phosphorus (calculated to PO_4) 2.3 per cent.

In recommending kelp in preference to inorganic salts of iodine, the author advances the opinion that "it is preferable that the body be permitted to secure its iodine from some natural vegetable carrier of iodine by natural digestive processes of selection and elimination through a prolonged digestive period rather than from some chemical, highly soluble and of high penetrative powers, against which the natural protective and defensive agencies of the body are not able to prevail."

Pellagra, N. M. OWENSBY (*Med. Jour. and Rec.*, 120 (1924), No. 8, pp. 377-379).—The author reviews the various theories which have been advanced as to the etiology of pellagra, and presents arguments in favor of the hypothesis that the principal factor involved is "an inadequate supply of the anti-neuritic vitamin B, with the lack of the antiscorbutic vitamin C playing a contributory rôle." In his own experience 28 pellagra patients are said to have been cured in from 3 to 16 weeks by the sole treatment of the addition of tomato juice, raw cabbage, lettuce, and the water in which vegetables had been cooked to the daily diet on which pellagra had developed.

Deficiency diseases, with special reference to rickets, E. MELLANBY (*Brit. Med. Jour.*, No. 3308 (1924), pp. 895-900, pls. 2).—In this British Medical Association lecture the author discusses, on the basis of the literature on the subject and his own investigations which have been noted elsewhere (E. S. R., 47, p. 270), the relationship between fat-soluble vitamins and the development of the bones, teeth, and muscle structure, the possible harmful interaction of cereals and fat-soluble vitamins and the relation of light radiation to fat-soluble vitamins, and presents the results obtained in the clinical application of the principles outlined, particularly as concerns the dietetic and combined dietetic and light treatment of rickets. The diets employed are designed to furnish an abundance of fat-soluble vitamins and calcium without excess of cereals, especially oatmeal, and to be otherwise well balanced. Specimen diets embodying these principles for children 3, 5, and 9 months of age and for adults are given, together with photographs illustrating the remarkable results obtained with them in cases of rickets and malnutrition. In the discussion of these diets, the dangers involved in the use of too restricted diets in the treatment of malnutrition and wasting of infants and dyspepsia in adults are emphasized.

The effect of pregnancy on the course of scurvy in guinea-pigs, H. J. GERSTENBERGER, W. M. CHAMPION, and D. N. SMITH (*Amer. Jour. Diseases Children*, 28 (1924), No. 2, pp. 173-182, figs. 2).—Evidence is presented that guinea pigs are less susceptible to scurvy during pregnancy. As compared with nonpregnant controls on the same scorbutic diet, the symptoms of advanced scurvy appeared later or not at all and were in all cases less severe. The survival period was, however, no longer than for the controls.

"It is suggested that probably the change in the picture of scurvy in pregnant guinea pigs is due to the changed metabolic conditions produced by pregnancy, which either raise the resistance of the animal to infections or enable it to economize in the use of the antiscorbutic vitamin. It is suggested that, even though symptoms of scurvy in the pregnant guinea pig are milder in degree, the animal's death after parturition is nevertheless due to the inadequate intake of the antiscorbutic vitamin."

ANIMAL PRODUCTION

Studies of the thyroid apparatus.—XXVI, Correlation between thyroid weight and body weight, F. S. HAMMETT (*Amer. Jour. Physiol.*, 69, (1924), No. 3, pp. 510-517, figs. 4).—The calculated coefficients of correlation between the body weights and weights of the thyroid glands in 121 male and 121 female rats 150 days of age are given. The coefficients calculated for rats having thyroids above the mean weight were -0.275 ± 0.105 for males and -0.268 ± 0.101 for females, and for animals having thyroids of less than the average weight 0.427 ± 0.059 for males and 0.389 ± 0.063 for females. The correlation for all males was very close to 0 and for females was 0.1.

Explanations for the correlations found are discussed in which it is indicated that the thyroid is the dominant regulator of metabolic processes determining the body weight irrespective of the sex. An earlier study of this series was noted (E. S. R., 50, p. 774).

The endocrine glands and the development of the chick.—I, The effects of thyroid grafts, B. H. WILLIER (*Amer. Jour. Anat.*, 33 (1924), No. 1, pp. 67-103, figs. 7).—In a study at the University of Chicago of the effect of additional thyroid on the development of chicks, a small piece of thyroid gland from chickens varying in age from 2 months to 2 years was transplanted to the vascular chorioallantoic membrane in 300 eggs by removing a portion of the shell. At the time of making the grafts the eggs had been incubated from 7 to 10 days. Of the grafts, 36 were successful and a study was made of the development of these chicks up to about 18 days of incubation, and they were compared with chicks at the same stage in 50 control eggs.

The effects of the thyroid grafts were variable, producing gradations from embryos which were apparently unaffected to ones in which there was a gradual reduction in body size. All parts of the smaller embryos were affected, including the head, eyes, beak, neck, appendages, etc. There was also a relative reduction in the size of the internal organs, including the gonads, thyroids, adrenals, thymus, hypophysis, and the normal storage of fat occurring in chick embryos at this age.

In many of the modified chicks proliferations of leucocytes were found in certain of the organs and led to the formation of necrotic nodules appearing first and most conspicuously in the spleen. Proliferation of leucocytes in the grafts was associated with a like condition in the spleen. By making successful grafts of portions of liver in 10 embryos and thymus in 4 embryos, it was also found that the leucocytic proliferation occurred in the spleen and in the grafts, though no diminution of body size or emaciation occurred. These results thus indicated the specificity of the action of the thyroid graft on the body size.

The author discusses five factors which may have contributed to the action of the thyroid grafts on the embryos, (1) time of introducing the graft and its vascularity, (2) duration of the graft, (3) the quantity of thyroid tissue in the graft, (4) differences in physiological activity of the graft, and (5) physiological condition of the host embryo. The author concludes that the action of the thyroid hormone seems to be to increase the catabolic rate.

Wyoming forage plants and their chemical composition.—Studies No. 6, A. T. CUNDY (*Wyoming Sta. Bul.* 137 (1924), pp. 3-16, figs. 4).—In continuing this series (E. S. R., 41, p. 333), samples of wire grass, carex, *Deschampsia timothy*, redtop, cord grass, smooth brome grass, *Eleocharis acicularis*, slender wheat grass, crested wheat grass, western wheat grass, wild sunflower, and wild sage (*Artemisia cana*), as collected at different periods during the haying seasons of 1922 and 1923 and from four different places each year, were

analyzed for the changes in composition occurring as the season advances. The results indicated that the crude protein content in practically all plants decreased at later stages in the season. Other changes in composition which occurred were variable in the different grasses.

Soft corn—how to store and feed it (*Illinois Sta. Circ. 293 (1924), pp. 3-16, figs. 7*).—Storing soft corn in silos and various methods of drying it in cribs are described. Suggestions are given for feeding soft corn, as well as a scheme for calculating its value on the basis of the market value of mature corn.

Limited use of shelled corn in fattening two-year-old cattle, E. A. TROWBRIDGE and H. D. FOX (*Missouri Sta. Bul. 218 (1924), pp. 14, figs. 6*).—The results of a 100-day feeding experiment in comparing limited and full feeds of corn with no corn for fattening two-year-old steers are reported. Five lots of 8 steers averaging 1,028 lbs. in weight were selected for the test. All lots received all the clover hay and corn silage they would eat. In addition, lot 1 received a full feed of shelled corn and linseed oil cake in the proportion of 6:1. Lots 2, 3, and 4 received the same amount of oil cake as lot 1 and in addition lot 2 received one-half as much shelled corn and lot 3 a full feed of shelled corn during the last 40 days. Lot 5 received 58 per cent more linseed oil cake than was fed to lot 1. Pigs followed the steers in all lots, but they were removed from lots 4 and 5 after 60 days, since no appreciable gains were made. The amounts of feed consumed and the gains made by the steers and pigs in the different lots are summarized in the following table:

Results of feeding limited and full rations of corn to cattle

Lot	Average initial weight	Average daily gain	Dressing percentage	Feed consumed per 100 lbs. gain				Pork gains per steer per 100 days
				Shelled corn	Linseed oil cake	Corn silage	Clover hay	
	Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1-----	1,036	3.05	60.5	544	90	892	65	50.5
2-----	1,042	2.37	61.5	342	114	1,493	98	30.2
3-----	1,024	2.45	60.1	228	113	1,546	109	19.5
4-----	1,011	2.36	60.7	-----	117	1,930	107	-----
5-----	1,030	2.29	61.4	-----	192	1,968	114	-----

[**Silage from corn stover and from normal corn for steers**], G. A. BROWN (*Michigan Sta. Rpt. 1923, pp. 169, 170*).—The results of another test of this experiment have been combined with the data from the two preceding years (E. S. R., 51, p. 171), with results substantially in accord. The corn stover plus ear corn gains were larger, but the costs were also greater, than in the lots receiving the corn stover.

Beef cattle investigations, 1923-24, C. W. McCAMPBELL (*Cattleman, 10 (1924), No. 12, p. 25*).—Ten lots of 10 beef cows each were successfully wintered on 10 different rations consisting entirely of roughages at the Fort Hays (Kans.) Substation. The wintering period lasted from November 15, 1923, to April 15, 1924, during which the following average gains per cow were made on the different rations: Cane hay 26 lbs., Sudan hay 64 lbs., alfalfa hay 6 lbs., cane hay and alfalfa hay 68 lbs., Sudan hay and alfalfa hay 45 lbs., cane hay and Sudan hay 28 lbs., wheat straw and cane hay 27 lbs., wheat straw and Sudan hay 7 lbs., kafir silage and cane hay 68 lbs., and kafir silage and Sudan hay 85 lbs. The cows receiving the combinations of the dry roughages received approximately 22 lbs. of the first and 4 lbs. of the second

roughage mentioned per day, while in the case of the two silage rations 11.6 lbs. of hay and 30.2 lbs. of silage were fed daily. The feed required for wintering averaged per cow approximately 2 tons of hay on the hay rations and on the silage rations about 0.9 ton of hay and 2.3 tons of silage.

Breeds of Italian sheep, S. SCIPIONI (*Razze Ovine Italiane. Catania: Francesco Battiato, 1924, pp. 75, pls. 16, figs. 3*).—Brief accounts are given of the various breeds of sheep in Italy.

The influence of variations in the sodium-potassium ratio on the nitrogen and mineral metabolism of the growing pig, M. B. RICHARDS, W. GODDEN, and A. D. HUSBAND (*Biochem. Jour., 18 (1924), No. 3-4, pp. 651-660, figs. 3*).—The effect on the nitrogen and mineral balances of the addition of sodium to the ration of pigs has been investigated in two experiments at the Rowett Research Institute. Throughout both experiments the animal received daily a basal ration of 775 gm. of a mixture consisting of 10 parts each of corn, oatmeal, and barley meal and 1 part of blood meal plus 25 cc. of a 20 per cent calcium chloride solution and 10 cc. of olive oil. From the sixth to the twelfth day of the first experiment, which lasted 19 days, 50 cc. of a 10 per cent solution of sodium chloride (increasing the Na_2O consumption by 2.5 gm.) were added to the ration and the daily nitrogen and mineral balances determined. Throughout the 36 days of the second experiment, 6 gm. of chalk was added to the ration and from the ninth to the twenty-second day the basal ration was supplemented with 50 cc. of sodium citrate, supplying approximately as much sodium as in the test period of the first experiment. The average daily balances are given in the following table, the first experiment being reported for the preperiod, test period, and postperiod, while in the second experiment the results are given for the halves of each period:

Average daily mineral and nitrogen balances of a pig on a basal diet and with additional sodium

Experiment	Period	Ration	Average daily balance						
			N	CaO	P_2O_5	MgO	Cl	Na_2O	K_2O
	Days		Gm.	Gm.	Gm.	Gm.	Gm.	Gm.	Gm.
1	1-5	Basal.....	4.79	0.11	1.03	0.09	-0.63	0.17	1.23
1	6-12	Plus sodium chlorid.....	5.17	.43	1.10	.14	-.10	.51	1.24
1	13-19	Basal.....	4.99	.56	1.21	.18	-.34	-.03	1.49
2	1-4	do.....	5.74	2.31	2.67	.14	-.38	-.10	1.76
2	5-8	do.....	5.69	2.21	2.49	.10	-.37	+.0	1.63
2	9-15	Plus sodium citrate.....	5.96	2.37	2.45	.07	-.41	+.54	1.21
2	16-22	do.....	6.44	2.58	2.88	.10	-.33	+.08	1.46
2	23-29	Basal.....	6.63	2.81	3.20	.17	-.37	-.40	1.96
2	30-36	do.....	6.81	2.95	3.20	.14	-.35	-.07	1.83

In both experiments the N, CaO, and P_2O_5 balances were increased during the sodium feeding periods. The addition of sodium to the ration increased the potassium excreted in the urine, but because of decreased fecal elimination the balance remained very much the same.

The merits of home-produced foods for pig-feeding, C. CROWTHER and W. S. CHALMERS (*Jour. Roy. Agr. Soc. England, 84 (1923), pp. 174-198*).—The results of a test of the comparative values of home-grown feeds for fattening hogs, conducted under the direction of the research committee of the Royal Agricultural Society, are reported. The test animals, which were of various breeding, averaged about 60 lbs. in weight at the beginning of the test. A summary of the feeds used in each of the 12 lots and the amounts

consumed during the 139-day experiment, as well as the average daily gains and feed consumed per pound of gain, is given in the following table:

Comparative test of home-grown rations for pigs

Lot	Average food consumed per pig throughout 139-day experiment										Average daily gain	Feed per pound of gain
	Barley	Sharps	Wheat	Oats	Beans	Peas	Raw potatoes	Cooked potatoes	Whey	Separated milk		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	382	199			50						0.87	5.2
2	302		158		45						.64	5.6
3	274		105	123	53						.75	5.4
4	387		114		125						.83	5.4
5	351		111		19	100					1.03	4.1
6	325		165		39		187				.60	6.9
7	314		161		39			185			.72	5.6
8	326		154		39		292				.65	6.4
9	327		155		39			306			.76	5.7
10	478		169		28				1,427		1.46	3.9
11	535		171							730	1.53	3.9
12	258		82	82	74	74	142	62		882	1.44	4.1

At the conclusion of the test those pigs which were properly finished were killed, but it was found that 3 from lot 1, 8 from lot 2, 4 from lot 3, 2 from each of lots 4 and 5, 8 from lot 6, 6 from lot 7, 7 from lot 8, and 4 from lot 9 were unfit for slaughter, due to the poor growth made. All the pigs from lots 10, 11, and 12 were well enough finished for slaughtering. The 44 unfinished pigs were placed on a ration of 50 per cent barley, 20 per cent sharps, 10 per cent bean meal, 10 per cent pea meal, and 10 per cent fish meal, and during the succeeding 66 days they made average daily gains of 1.62 lbs. per head, indicating that the poor gains made in the earlier part of the experiment were due to the rations and not to individuality.

The conclusions derived from the experiment indicated that oats and wheat should be fed to pigs in only limited amounts. Potatoes did not greatly improve a barley and wheat ration, though bean meal did bring about a distinct improvement. Cooked potatoes were more palatable than raw potatoes, and the pigs receiving them were in better condition. By far the greatest improvement to any of the rations was brought about by the addition of the dairy products.

[Feeding experiments with swine at the Michigan Station], G. A. BROWN (*Michigan Sta. Rpt. 1923, pp. 170, 171*).—Two experiments were conducted in comparing feeds for fattening hogs.

[Free choice v. hand mixing feeds for self-feeding hogs].—Two lots were fattened on each of the seven rations fed in a previous experiment (E. S. R., 51, p. 174). One lot on each ration received the feeds in separate self-feeders, while the same feeds were mixed according to accepted standards for the other lot. With the exception of one ration, i. e., rye and tankage, the gains were greater when the feeds were mixed.

[Powdered skim milk].—Three lots of 5 pigs averaging about 75 lbs. each in weight were fed supplements of tankage, skim milk, and powdered skim milk to a ration of corn. The average daily gains were, respectively, 1.36, 1.65, and 1.56 lbs. when the different supplements were fed. It was estimated that 57.7 lbs. of powdered skim milk replaced 47.4 lbs. of tankage and 36.4 lbs. of corn, while 613.3 lbs. of skim milk replaced 47.4 lbs. of tankage and 56.4 lbs. of corn.

Feeding brood sows and growing the litters, W. E. JOSEPH (*Montana Sta. Bul. 165 (1924), pp. 18+IX, figs. 6*).—The results of several tests of methods

of feeding brood sows and their litters are popularly reported. The use of pasture was found to afford a considerable saving of grain and kept the sows in a thrifty condition. Alfalfa pasture as a sole feed was satisfactory for dry sows in good condition, but additional feeding during gestation and lactation, especially when two litters are produced annually, proved economical in that the pigs were stronger and more thrifty after weaning. Large-sized litters and two litters per year materially reduced the cost of feed per weaned pig.

Pigs weaned when weighing from 45 to 50 lbs. did better on a ration of barley and tankage than pigs weaned at from 30 to 35 lbs. in weight. Less feed was also required per unit of gain in the former case. There was little advantage for the late weaning, however, when skim milk and pasture or alfalfa hay were available. Barley and alfalfa hay proved a sufficient ration for brood sows given pasture in the early spring and late fall, but the addition of skim milk proved beneficial. In a comparison of fall and spring litters, it was found that fall pigs were raised practically as economically as spring pigs when neither had access to pasture.

In these tests old sows were found to raise pigs at from 5 to 10 per cent less cost than young sows when one litter was raised per year, and at from 15 to 25 per cent less cost when two litters were raised annually. The more detailed data on each of the experiments are given in the appendix.

Studies upon the influence of various foodstuffs on the growth of chickens [trans. title], H. MAŁARSKI (*Pam. Państ. Inst. Nauk. Gosp. Wiejsk. Puławach* (*Mém. Inst. Natl. Polonais Écon. Rurale Puławy*, 3 (1922), A, pp. 277-320, figs. 4).—Based on a study with 23 luts comprising 229 chicks using different rations, curves for normal growth were constructed and comparisons of different feeds were made. Hard-boiled eggs were found to be unsatisfactory, but, after becoming accustomed to them, the chicks may grow normally. A product called egg cheese prepared by heating 250 cc. of milk and 3 eggs to the coagulating point made a satisfactory ration when fed alone or with polished barley. Chicks fed on beans alone or in combination with polished barley and lard made almost no growth up to 10 days of age.

The general results of the experiments on feeding indicated that overfeeding or underfeeding baby chicks both result in diminished growth, which can not be recovered by further careful feeding. The feed consumption seemed to be about the same whether the chicks were fed every two hours or only four times daily. The normal ration should be from about 35 to 40 per cent of the weight of the bird and contain in 100 gm. 8 gm. of solids, 2 gm. of digestible protein, and 10 gm. starch value. The author also believes that chicks should receive feed as soon as possible and not be made to wait from 36 to 48 hours after hatching as is the usual practice. An English abstract accompanies this article.

Kikuyu grass for poultry, G. L. SUTTON (*Jour. Dept. Agr. West. Aust.*, 2. ser., 1 (1924), No. 2, pp. 139-141, fig. 1).—Success is reported in the use of kikuyu grass (*Pennisetum clandestinum*) as a forage crop for poultry. The analysis of kikuyu hay, as determined, was as follows: 7.6 per cent water, 17.4 per cent crude protein, 1.1 per cent fat, 42.4 per cent carbohydrate, 22.1 per cent crude fiber, and 9.4 per cent ash.

Seasonal and annual egg-production-correlation tables, G. W. HERVEY (*New Jersey Stas. Bul.* 402 (1924), pp. 3-15).—This consists of a series of correlation tables showing the relation between the seasonal and annual egg production during the first and second years for the combined records of the 769 White Leghorns in the first Bergen County egg-laying contest and the 417 in the first Vineland contest. The seasonal relationships for the latter groups were previously presented and discussed in Bulletin 389 (E. S. R., 50, p. 779).

DAIRY FARMING—DAIRYING

Milk and science, L. LINDET (*Le Lait et la Science*. Paris: Payot, 1923, pp. 144).—This book gives a popular account of the selection, care, and diseases of dairy cattle; the physiology of milk secretion, and the chemical and biological constituents of milk; the bacteriology of milk; the control of dairies and dairy products; dairy mechanics; dairy associations; and the nutritional value of milk, with an account of the diseases likely to be transmitted to man.

The minimum protein requirement for growing dairy heifers, W. W. SWETT, C. H. ECKLES, and A. C. RAGSDALE (*Missouri Sta. Research Bul.* 66 (1924), pp. 5-155, figs. 11).—This is a complete report of the investigation of the protein requirements of Holstein and Jersey heifers during growth, which was previously abstracted from a brief note (E. S. R., 51, p. 777). Weights and body measurements were taken at 28- and 30-day intervals on 16 Jersey and 18 Holstein heifers fed on rations supplying varying amounts of protein and calculated amounts of energy sufficient for or in excess of the requirements. The records of the Jerseys covered the equivalents of 247.8 30-day periods, while the Holstein records were for 261 periods of like length. The heifers ranged in age from a minimum of 5 months 25 days to a maximum of 33 months 14 days at the beginning of the last period on which records were taken.

Tables show the actual amounts of digestible protein and energy supplied to each heifer during each period with relation to the calculated requirements as determined by the Wolff-Lehmann standard for digestible crude protein and the Armsby standard for digestible true protein and energy, and the relation of the actual weight and height to the normal weight and height during each period. The following table gives a summary of the combined individual results on the different planes of protein intake, in which from 8 to 10, 15, 20, and 25 to 35 per cent of the net energy for growth was furnished by the protein:

Protein requirement for Holstein and Jersey heifers

Breed	Total 30-day periods	Net energy from protein, calcu- lated plane	Actual digesti- ble crude protein received daily	Wolff- Lehmann digesti- ble crude protein require- ments actually received	Armsby true pro- tein require- ments actually received		Digesti- ble crude protein received per pound of gain
					By age	By weight	
	No.	Per ct.	Lbs.	Per ct.	Per ct.	Per ct.	Lbs.
Holstein.....	62.0	8-10	0.641	54.2	48.0	47.2	1.98
Jersey.....	49.4	8-10	.492	47.8	37.3	38.7	5.32
Average.....	111.4		.575	51.4	43.2	43.4	3.46
Holstein.....	92.0	15	.778	67.1	54.6	51.9	1.45
Jersey.....	75.0	15	.655	64.1	52.7	53.0	2.23
Average.....	167.0		.722	65.8	53.7	52.4	1.80
Holstein.....	54.0	20	.937	82.7	66.4	62.9	2.12
Jersey.....	69.0	20	.748	75.4	57.8	58.3	2.80
Average.....	123.0		.831	78.6	61.6	60.3	2.10
Holstein.....	53.0	25-35	1.077	98.2	83.7	78.8	1.20
Jersey.....	54.4	25-35	1.010	99.9	74.5	75.4	2.32
Average.....	107.4		1.052	99.1	79.0	77.1	1.77

Protein requirement for Holstein and Jersey heifers—Continued

Breed	Actual net energy received daily	Armsby true protein requirements actually received		Net energy received per pound gain	Normal gain in weight on this plane	Normal gain in height at withers on this plane
		By age	By weight			
	<i>Therms</i>	<i>Per ct.</i>	<i>Per ct.</i>	<i>Therms</i>	<i>Per ct.</i>	<i>Per ct.</i>
Holstein.....	7.23	109.5	103.2	21.88	67.9	106.7
Jersey.....	6.02	96.4	103.9	66.28	48.9	92.1
Average.....	6.69	103.7	103.5	41.57	59.5	100.2
Holstein.....	7.62	125.4	111.6	13.52	94.0	100.4
Jersey.....	6.17	107.0	107.3	20.86	77.3	85.3
Average.....	6.97	117.1	109.6	16.82	86.5	93.6
Holstein.....	7.13	118.2	104.3	15.86	107.5	112.3
Jersey.....	5.90	106.1	107.2	15.89	80.7	93.0
Average.....	6.44	111.4	105.9	15.88	92.5	101.5
Holstein.....	6.92	121.0	107.0	8.29	122.6	129.7
Jersey.....	5.82	95.6	98.6	13.75	101.9	109.7
Average.....	6.37	108.1	102.8	11.05	112.1	119.6

The results indicated a steady increase in the rate of gains in weight on the higher protein rations. This was also true of height but to a lesser extent. A breed difference in the protein requirements was also evident, as Holsteins made normal growth on a lower plane than did Jerseys. In studying the relation of the supply of protein to the rate of growth, it was shown that the increased rates on the higher protein planes were not made as economically as on the lower protein levels. The medium protein planes of nutrition tended to become more efficient with advancing age. An excess of energy in the ration seemed to reduce the amount of protein necessary for normal growth. In comparing the Wolff-Lehmann and Armsby standards for protein, it was pointed out that the former is from 20 to 25 per cent and the latter from 50 to 60 per cent too high for the promotion of normal growth. Both standards apparently fail to make sufficient allowance for advancing age.

Experimental feeding [with dairy cattle], G. B. ROTHWELL (*Canada Expt. Farms, Anim. Husb. Div. Interim Rpt. 1922, pp. 5-16*).—The following experiments in comparing different feeds for milk production and growing calves are briefly reported:

The value of dried beet pulp in the dairy cow's ration.—The replacement value of dried beet pulp for milk production was tested with 4 lots of cows fed during 3 periods of 3 weeks each. All lots received during the first and third periods a regular ration of hay, corn silage (mangels in lot 2), and a grain mixture composed of wheat bran, brewers' grains, hominy, and oil cake meal, 5:5:3:3. During the second period dried beet pulp soaked in water was substituted on a dry matter basis for one-half of the grain mixture in lot 1, one-half of the root ration in lot 2, one-half of the silage ration in lot 3, and for all the silage ration in lot 4. The principal results of the experiment are summarized in the following table:

Summary of experiments using dried beet pulp for milk production

Lot	Average milk production per day		Average fat production per day		Grain consumed per 100 lbs. of milk produced		Estimated feed cost per 100 lbs. milk	
	Regular ration	Beet-pulp ration	Regular ration	Beet-pulp ration	Regular ration	Beet-pulp ration	Regular ration	Beet-pulp ration
	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>	<i>Lbs.</i>		
1.....	29.70	31.40	1.10	1.09	35.70	16.80	\$1.00	\$0.85
2.....	37.40	41.05	1.18	1.31	32.15	30.40	1.18	1.93
3.....	20.20	22.50	.82	.81	40.00	35.50	1.19	1.18
4.....	14.10	16.90	.62	.66	38.00	31.50	1.40	1.31

The results indicated that dried beet pulp may be used to replace portions of the grain, roots, or silage, but that its greatest value was in the replacement of roots.

Sunflower ensilage v. corn ensilage.—As in the comparisons of corn silage and sunflower silage previously noted (E. S. R., 51, p. 578), the former excelled the latter in palatability, amount of milk produced, silage consumed per 100 lbs. of milk or fat produced, and in the cost of the products. This experiment was conducted by reversing the type of silage in 4 successive periods of 3 weeks' duration.

Calf feeding experiments.—The data as to weights, gains, feeds consumed, and costs of each of 6 lots of calves during a 56-day feeding period are tabulated in detail. The calves averaging from 80 to 95 lbs. in weight were fed 3 different rations. The 2 lots receiving a ration of fresh unpasteurized whole milk to which was added a little C. E. F. calf meal and access to a grain mixture of corn, bran, and oil meal made average daily gains per head of 0.69 and 0.89 lb. The 2 lots receiving fresh, unpasteurized whole milk for 10 days, followed by skim milk plus a home mixed calf meal composed of oatmeal, ground corn, and ground flax, 2:2:1, made average daily gains of 0.75 and 0.85 lb. respectively. Two other lots receiving the same ration except that Blatchford's calf meal replaced the home mixed meal did not do well, and at the end of 36 days the ration was changed to include the home mixed calf meal. The gains of these 2 lots were 0.85 and 0.79 lb., respectively. The results indicate that skim milk and home mixed calf meal were as efficient as whole milk in producing gains in calves, but data on the costs of the feed indicated that the calf raising enterprise for making better veal was unprofitable.

Feeding trials with silage, V. C. FISHWICK (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 1, pp. 50-58, pl. 1).—The results of 3 trials at the South Eastern Agricultural College, Wye, in which the feeding value of oat and tare silage was compared with roots are reported. In the first trial, conducted in 1921-22, 6 dairy cows were divided into 2 lots. The average rations fed to the 2 lots were as follows: The silage ration, 3 lbs. of straw, 6 lbs. of hay, and 45 lbs. of silage; and the root ration, 9 lbs. of straw, 8 lbs. of hay, and 56 lbs. of mangels. In addition, 2 lbs. of oats, 1 lb. of cottonseed cake, and 1 lb. of linseed cake were fed per gallon of milk produced. The test was continued over a 2 weeks' preliminary period and two 5-week test periods, with a 2 weeks' transition period during which the rations of the two lots were reversed. The amounts of milk and the costs of the feed, when using the two rations, were practically identical.

In the second trial with dairy cows, conducted in 1922-23, a similar type of silage, but consisting mostly of tares, was compared with mangels. Eight cows were divided into 2 lots of 4 each and fed during four 3-week periods, with 1-week transition periods during which time the rations were reversed. The total production for the two lots on the silage ration during 2 periods each was 10,574.5 lbs. of milk and on the mangel ration 11,176 lbs. of milk. In this experiment some deterioration in the quality of the silage toward the bottom of the silo was noted and possibly accounted for the less satisfactory results with the silage.

Using the same silage which was fed in the first milk production experiment, 2 lots of 7 steers each were fattened on rations, one of which contained silage and the other swedes. The balance of the rations included straw, cottonseed cake, and linseed cake. The lot receiving 50 lbs. of silage per head daily made average daily gains per head of 2.1 lbs. from November 6, 1922, to March 8, 1923. The average daily gains of the other lot receiving from 70 to 84 lbs. of swedes daily were 1.9 lbs. No differences in the condition of the live

animals or in the carcasses from the two lots were observed. The calculated costs of the silage ration in the last two experiments were somewhat greater, however.

A contribution to the study of grass silage and its relation to milk and its products.—II, *The microflora of ensiled forage* [trans. title], G. DALLA TORRE (*Ann. Ist. Sper. Caseif. Lodi*, 2 (1923), No. 3-4, pp. 87-128, figs. 2).—In a study of the bacterial flora of silage, considerable variation in the bacterial content has been found, from several thousand to several million bacteria being observed per gram in different samples. Spore formers and lactic ferments have usually been present, though yeasts have been found at times in the largest quantities. There was a gradual diminution of the germ content from the top of the silo toward the bottom. Considerable variation in the butyric ferments was found, from 28 to 12,762 per gram.

The water content of the silage seems to be a very important factor in affecting the variation in the numbers of bacteria found. No relationship to the presence of the bacteria in the silage and that found in the milk was observed except that the butyric ferments increased abundantly in their passage through the animal body, and silage may tend to increase the bacterial content of the milk if it is allowed to come in contact with it through careless methods.

Pineapple "bran" as a feed for dairy cows, L. A. HENKE (*Hawaii Univ. Quart. Bul.*, 3 (1924), No. 1, pp. 20-27).—In a feeding test at the University of Hawaii, lasting for six 2-week periods, using 6 cows divided into 2 lots, nearly the same amounts of milk were produced when a grain mixture containing 31 per cent of dried pineapple bran was included as when an equal amount of corn replaced the pineapple bran. The other ingredients of the ration included wheat bran, coconut meal, linseed oil meal, beet pulp, and several roughages, over half of which consisted of alfalfa and cowpeas. The ration including pineapple bran produced milk more cheaply, but a study of the rate of decline of the milk flow with advancing lactation indicated that such decline was greater when this material was fed than with the other more usual feeds.

Better sires—better stock.—Build better by breeding, H. P. DAVIS (*Nebraska Sta. Circ.* 24 (1924), pp. 3-24, figs. 7).—This consists essentially of a history of the improvement of the Holstein herds of the North Platte Substation and the dairy husbandry department at Lincoln. The effect of the different sires on the production of the herd has been reviewed, and the records of certain of the individuals are tabulated.

A comparison of Holstein-Friesian sires, based on the average "mature equivalent" fat production of the daughters, C. W. TURNER and A. C. RAGSDALE (*Missouri Sta. Bul.* 217 (1924), pp. [32], figs. 2).—Data as to 229 Holstein-Friesian sires having 10 or more daughters with long-time records in the Advanced Register have been tabulated, showing the average yearly butterfat records of the daughters and the number producing 400 to 600, 600 to 800, 800 to 1,000, and over 1,000 lbs. of butterfat annually. All records were corrected for mature age and for 365 days when they were terminated in less than that time. The pedigrees of all the sires are given, while their dams, maternal grandsires, and granddams are tabulated.

The relation of leucocytes to mammary secretion, H. L. WEATHERFORD and V. E. EMMEL (*Abd. in Anat. Rec.*, 27 (1924), No. 4, p. 191).—In a study at the University of Illinois of the rôle of leucocytes in mammary secretion, it has been found that many eosinophiles and lymphocytes are present in the active mammary gland. Many of the lymphocytes migrate into the alveoli and are transformed into the typical corpuscles of colostrum.

The influence of certain factors on the hydrogen ion concentration of milk, I. E. DUNCOMBE (*Jour. Dairy Sci.*, 7 (1924), No. 1, pp. 86-93).—In study-

ing the factors affecting the H-ion concentration and the total acidity (by titration) of milk at the Indiana Experiment Station, it was found that the feeding of acids to two cows in the evening in amounts as great as 80 cc. of 85 per cent lactic acid, 50 cc. of 85 per cent phosphoric acid, 100 cc. of 60 per cent butyric acid, or 50 cc. of glacial acetic acid per day had no influence on the acidity of the milk produced in the morning. Changing from a winter to a pasture ration resulted quite uniformly in decreasing the total acidity of the milk, while the H-ion concentration was irregularly affected.

Studies concerning the handling of milk, compiled by S. WILLIAMS ET AL. ([*Gt. Brit.*] *Min. Agr. and Fisheries, Misc. Pub.* 41 (1924), pp. 47, pls. 2, figs. 2).—This consists of brief accounts of investigations in the production of milk and dairy products conducted at the National Institute for Research in Dairying at Reading, most of which have been noted from other sources.

A simple method of determining the keeping quality of milk, J. M. FULLER, H. F. DEPEW, and B. E. HUGGINS (*New Hampshire Sta. Circ.* 23 (1924), pp. 12).—Comparisons have been made of the methylene blue reductase test with plate counts, souring time, and the development of acidity in various samples of milk. The results indicate that the time required for reduction of color gives a fairly good indication of the relative bacterial content and is a much better indicator of the keeping quality of milk than an acidity test. It is recommended that milk be graded as poor when decolorization occurs in less than 2 hours and good when more than 5½ hours are required for decolorizing.

A study of methods for bacterial analyses of market milk, L. H. COOLEGE (*Michigan Sta. Rpt.* 1923, pp. 184-189, fig. 1).—Increases in the bacterial content of samples of milk incubated for 1- and 2-hour periods were determined by the pH method (E. S. R., 43, p. 615), and by making the plate counts on Bacto agar, meat infusion agar, milk powder agar A, and beef extract agar. No one method was entirely accurate as an indicator of the quality of the milk, but the pH method proved more efficient in determining the aged milk.

Ropy or slimy milk, J. W. KALKUS (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 4, pp. 82, 83).—This is a discussion of the cause of ropy or slimy milk. The organism accountable for this condition may be prevalent in wash water and drinking water and thus gain entrance to the milk, or it may be present on the utensils, in which case thorough sterilization should remedy the difficulty.

[Sugar substitutes in ice cream], O. E. REED (*Michigan Sta. Rpt.* 1923, p. 173).—The following substances were found to be equivalent to 1 lb. of cane sugar in sweetening value: 3.26 lbs. of glucose, 1.74 lbs. of honey, 1.51 lbs. of maple sirup, 1.59 lbs. of corn sugar, 2.46 lbs. of Karo sirup, and 1.38 lbs. of invert sugar sirup. Corn sugar seems to offer the greatest possibilities, though it is more expensive than cane sugar. Invert sugar sirup closely resembles cane sugar in taste.

Ice cream plant and manufacture, R. G. REID (*London: A. J. Rayment*, 1924, pp. [10]+136, figs. [89]).—This book contains descriptions of ice cream machinery and directions for preparing the mix, freezing and hardening, and the manufacture of packaged ice cream.

VETERINARY SCIENCE

[Annual administration reports of the Civil Veterinary Department in Ajmer-Merwara (British Rajputana) for the years 1922-23 and 1923-24], J. H. G. JERROM (*Ajmer-Merwara Civ. Vet. Dept. Ann. Admin. Rpts.*

1922-23, pp. 10; 1923-24, pp. 10).—These, the usual annual reports (E. S. R., 48, p. 480), include statistical data regarding contagious diseases among animals, etc., during the periods under report.

An improved neutral red light green double stain, for staining animal parasites, microorganisms, and tissues, F. W. TWORT (*Jour. State Med.*, 32 (1924), No. 8, pp. 351-355).—This is an account of a stain prepared by the author about 20 years ago, no account of which in full has previously been published.

Immunisation of animals against infection by *Vibrio septique* and *Bacillus chauvoei*, H. R. ALLEN and T. J. BOSWORTH (*Vet. Jour.*, 80 (1924), No. 9, pp. 344-362).—The literature on *V. septique* and *B. chauvoei* as the causal agents in pathological conditions diagnosed as blackleg and on methods of immunization against the two organisms is reviewed, and the methods employed by the authors in such immunization are described with data on the immunization of guinea pigs and sheep.

In the case of both organisms filtered artificial cultures are used as the foundation material. As a culture medium a tryptic digest broth to which fresh minced meat is added has been found most satisfactory. The medium is prepared on a large scale as follows: Fourteen kg. of meat separated from fat and connective tissue is distributed into four receptacles, and 3 liters of water is added for every 2 kg. of meat. The mixture is allowed to stand at room temperature over night and then heated to 80° C. to destroy any antitryptic action. An 0.8 per cent solution of anhydrous sodium carbonate is added in the proportion of 3 liters to 2 kg. of muscle, and when the temperature has reached 45° the trypsin extract and chloroform are added, 4 cc. of the former and 15 cc. of the latter per kilogram of meat. After the digestion has proceeded for six hours in the incubator at 37° with frequent stirring, the contents of the different receptacles are transferred to a cauldron provided with a steam jacket and the action of the trypsin is stopped by adding 350 cc. of N HCl and heating to 100°. The material is filtered immediately and allowed to stand over night, after which it is made alkaline, distributed in 1,800-cc. quantities, and each portion thoroughly mixed with 150 gm. of fresh minced muscle (horse flesh or beef). The temperature is raised to 100° and allowed to cool, after which the broth is poured off, its reaction adjusted to pH 8, and again heated to 100°. After filtering, the broth is poured back on the meat and autoclaved by allowing free steam to pass through for 60 minutes, and then raising the pressure slowly to 10 lbs. and maintaining it at this pressure for 20 minutes. Each flask of the medium as thus prepared is inoculated with 30 cc. of a 24-48 hours' broth culture of the organism, with sufficient sterile glucose solution added to give a concentration of 0.2 per cent. Growth is allowed to proceed for from 2 to 4 days with *V. septique* and for 5 days with *B. chauvoei*, and the material is then filtered through Berkefeld candles.

The filtered culture of *V. septique* contains a toxin which retains its potency when kept in the cold but deteriorates rapidly at room temperature and with exposure to light. To determine the strength of the toxin and of toxin-antitoxin mixtures, intravenous inoculation of mice and rabbits was used.

In the immunization of guinea pigs against *V. septique*, the subcutaneous injection of toxin proved unsatisfactory on account of serious local effects at the site of injection. By using a mixture of toxin and antitoxin or by reducing somewhat the toxicity, successful results were obtained. In testing for immunity, the intramuscular injection of cultures and the intravenous injection of toxin were both used, the latter being preferred since it could be more accurately measured.

The filtrates prepared from cultures of *B. chauvei* all proved nonvirulent and consequently could not be standardized other than by animal tests. As in the case of *V. septique*, double doses produced a higher degree of immunity than single.

Guinea pigs were immunized successfully against both *V. septique* and *B. chauvei* by inoculation of *V. septique* toxin-antitoxin mixture combined with *B. chauvei* filtrate.

In sheep experiments data are reported on the immunization of 3 sheep against *V. septique*, 2 against *B. chauvei*, and 7 against both organisms. In most cases the dose of *V. septique* was 5 cc. of a 25 per cent underneutralized toxin-antitoxin mixture injected subcutaneously and repeated after from one to two weeks. The test dose for determining immunity was 4 cc. of *V. septique* liver broth culture injected intramuscularly. The *B. chauvei* filtrate was injected subcutaneously in a single dose of 5 cc. and tested by the injection of 3 cc. of *B. chauvei* culture. In the simultaneous immunizations, the dosage was the same as in the single immunization.

The results obtained showed that a single dose of *V. septique* toxin-antitoxin mixture does not produce sufficient immunity to enable the animal to withstand inoculation with a fatal dose of culture after an interval of 2 months. Two such doses are efficient for a period of 5 months at least. A single dose of *B. chauvei* filtrate affords protection for a period of at least 6 months. The simultaneous immunization with a combination of these products immunizes against both organisms. Although immunity was secured in the case of *V. septique* with an interval of only a week between the two immunizing doses, it is considered of advantage to allow an interval of about 2 weeks.

Attenuation of the virulence of *Bacillus anthracis* in spore form.—Immunizing power of the attenuated bacillus [trans. title], E. DUCLOUX (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 10, pp. 510-512).—Using as a culture medium a fish liver bouillon prepared by macerating 15 or 20 gm. of the liver in 100 gm. of water for several hours, boiling for a few minutes, and sterilizing at 120° C., the author has succeeded in attenuating the virulence of Tunisian strains of *B. anthracis* to a degree sufficient to use as a vaccine. Experiments in the use of this vaccine are reported as follows:

One lot of 66 sheep of European strain was vaccinated with $\frac{1}{2}$ cc. each of the first and second vaccine at 12-day intervals. In testing for immunity, 22 of the vaccinated sheep received a drop each of a virulent 36-hour culture in ordinary bouillon. All survived, while of 5 controls receiving the same amount of virus 3 died of anthrax after 48 hours and the other 2 showed a rise in temperature and extensive edema. The remaining 44 vaccinated sheep received $1\frac{1}{2}$ drops each of the 36-hour culture, and 4 died of anthrax 4 days later. Five control lambs died of anthrax in from 48 to 72 hours.

As a comparative test 50 sheep were vaccinated simultaneously with the first lot with a foreign vaccine and tested with the virulent culture as follows: Of 29 sheep receiving 1 drop of the virulent culture 7 died of anthrax in 60 hours, and of the 21 receiving $1\frac{1}{2}$ drops 11 died in from 36 to 108 hours. The superiority of the vaccine prepared by the author is shown by the difference in percentage mortality of the two groups, 6 and 36 per cent, respectively. It is stated that the vaccine has been used with satisfactory results in the immunization of a large number of cattle and sheep.

Dangers in the immunization of cattle against foot-and-mouth disease by the subcutaneous injection of virulent blood [trans. title], J. BASSET (*Bul. Soc. Cent. Méd Vét.*, 100 (1924), No. 6, pp. 142-152).—This discussion of dangers involved in attempts at immunizing cattle by the subcutaneous injection of virulent blood, as recommended by Roux, Vallée, et al. (*E. S. R.*, 46,

p. 579), was occasioned by the recommendation of Panisset that hemolyzed virulent blood be used. In the author's opinion this would be fraught with even greater danger than untreated virulent blood. As an illustration it is reported that in a district free from foot-and-mouth disease 129 cattle were given subcutaneous injections in the conjunctival tissue of less than 1 cc. each of laked blood taken from cattle of the same region during the preeruptive febrile period. Of these, 100 contracted the disease and 11 died, including all of the 6 heifers thus treated.

The rabies parasite, *Encephalitozoon rabiei* [trans. title], Y. MANOUELIAN and J. VIALA (*Ann. Inst. Pasteur*, 38 (1924), No. 3, pp. 258-267, pls. 4; *abs. in Jour. Compar. Path. and Ther.*, 37 (1924), No. 2, pp. 125-128; *Trop. Vet. Bul.*, 12 (1924), No. 3, pp. 101, 102).—Under the name *E. rabiei*, the authors describe the intracellular bodies occurring in the central and peripheral nervous system and in the salivary glands of man, dogs, rabbits, and monkeys, which they identify as the causal organism of rabies. Their conclusion is based upon the constant presence of these bodies in the infective organs in all forms of rabies, the regular form of the parasite, and its staining reactions which are those of a protozoan. In the authors' opinion, Negri bodies, which may be found in cells occupied by the parasite, result from the degeneration of masses of the parasite.

Antirabic vaccination of animals, S. KONDO (*Vet. Med.*, 19 (1924), No. 11, pp. 592, 593).—The author reviews previous work of other Japanese investigators on antirabic vaccination of dogs and describes his method of preparing the vaccine. This differs from that of Umeno and Doi (*E. S. R.*, 47, p. 385) in that the phenolized emulsion of the virus is attenuated by incubation at 37° C. for 3 days instead of at room temperature for 2 weeks. The vaccine is prepared by grinding the brain and spinal cord of a dog killed when in a state of paralysis from artificially induced rabies, and adding a solution containing 0.5 per cent phenol and 50 per cent glycerol in the proportion of 1 part of the tissue to 5 parts of the solution. The emulsion is filtered through sterile cloth, placed in 100-cc. vials, and incubated as noted above.

The dose of the vaccine is from 3 to 5 cc. for dogs, from 4 to 5 times as much for sheep and swine, and about 10 times as much for cattle and horses. It is stated that in 12 prefectures in Japan 20,117 dogs were vaccinated from June, 1919, to February, 1921, with no other losses than 4 deaths within a week from natural infection which occurred before vaccination. No cases of rabies developed among the vaccinated dogs for a year after treatment, although many cases occurred during this time among the unvaccinated animals.

Report on the search for a method for the active immunization of suckling calves of cows refractory to rinderpest [trans. title], DOUTRES-SOULLE (*Rec. Méd. Vét.*, 100 (1924), No. 15, pp. 464-468).—Attention is called to the fact that calves of cows which have been rendered refractory to rinderpest through recovery from the disease are immune during the suckling period, but are very susceptible soon after weaning. Attempts at the serum immunization of such calves have been unsuccessful, but a considerable degree of immunity has been secured by a single injection of 0.1 cc. of citrated virus from a diseased calf.

The concentration of bacteria, including tubercle bacilli, by the use of aluminium hydroxide cream, C. C. SÆLHOF (*Amer. Rev. Tuberculosis*, 9 (1924), No. 2, pp. 97, 98).—Aluminum hydroxide cream, prepared by adding a slight excess of a 1 per cent solution of ammonium hydroxide to a 1 per cent solution of ammonium alum at room temperature and washing by decantation until the wash water shows only the faintest trace of residue on evaporation,

is said to be a useful medium for the concentration of microorganisms which do not take the counterstain by the Gram method. The method consists in adding a few drops of the cream to the material, shaking the tube vigorously for two minutes, and centrifuging just long enough to throw out the cream. In duplicate tests conducted with this method and the ordinary method of centrifuging for one-half hour on a suspension of *Staphylococcus albus* and samples of tuberculous arachnoid fluid and tuberculous sputum treated by the antiformin method, from 10 to 50 per cent greater yield of the organism was obtained by the aluminum cream method, with a saving of at least 20 minutes in time.

The use of volatile hydrocarbons in the concentration of tubercle bacilli, P. M. ANDRUS and H. E. MACMAHON (*Amer. Rev. Tuberculosis*, 9 (1924), No. 2, pp. 99-106).—In the concentration of tubercle bacilli from sputum, the authors have obtained excellent results by dissolving the material in 0.5 per cent NaOH at from 55 to 65° C., shaking in a mechanical stirrer with chloroform, and separating by centrifugation. The technique is described and discussed, and the results obtained are compared with those obtained by other methods and checked by guinea pig inoculation. The method is said to give a large increase in positive findings over the repeated direct method.

The diagnosis of tuberculosis in domestic carnivora [trans. title], J. title], H. VALLÉE (*Rec. Méd. Vét.*, 100 (1924), No. 17, pp. 513-517).—The author with references to the literature and to the author's experience, of methods of diagnosing tuberculosis in domestic animals, particularly dogs. The methods outlined include clinical diagnosis, diagnosis by tuberculin, examination of the excreta, animal inoculation, the agglutination, complement fixation, and formol tests, and radioscopic examination. Of the various methods other than clinical, the complement fixation test, as previously described (*E. S. R.*, 49, p. 78), is considered the most reliable. The radioscopic examination is thought to be of value and worthy of more attention. In conclusion the dissemination of tubercle bacilli from infected dogs is discussed, and the danger of human infection from such sources is pointed out.

The prevention of tuberculosis and various chronic infections [trans. title], H. VALLÉE (*Rec. Méd. Vét.*, 100 (1924), No. 17, pp. 513-517).—The author suggests as a means of preventing chronic tuberculosis and probably other infections which are capable of existing in chronic form the subcutaneous inoculation of the attenuated organism in question emulsified in a nonabsorbable medium such as a suspension of talcum in liquid petrolatum. Following such an inoculation of cattle with attenuated tubercle bacilli, the organisms are said to persist for a long time in local lesions at the site of the inoculation, whereas following similar inoculations of the bacilli in suspension in an absorbable medium, such as physiological salt solution, the bacilli are rapidly absorbed.

The protection secured by the first method is said to be lasting, while that of the second is only transitory. In place of the term immunity in such a condition the author prefers the term inaptitude to infection. It is stated that successful results have been obtained in the use of killed tubercle bacilli. The principle is thought to be of application in the protection of human beings against tuberculosis and of possible application in the protection of cattle against paratuberculous enteritis and contagious abortion.

Report of the section of animal pathology [of the Michigan Station], E. T. HALLMAN (*Michigan Sta. Rpt.* 1923, pp. 174-176).—Continuing investigations of the diseases of the reproductive organs of cattle (*E. S. R.*, 51, p. 182), particular attention was given to the bacteriology and histopathology of the reproductive organs of pregnant cattle from abortion infected herds. Much

time was spent upon a method of staining both Gram-negative and Gram-positive organisms in sections from the reproductive organs of pregnant cattle, with considerable success. By a method which is a combination of the Goodpasturiz and Weigert Fibrin stains, the author was able to demonstrate large numbers of cell inclusions in both the chorionic and maternal epithelium of the placental and interplacental areas. These inclusions, which resemble abortion bacilli, were found in large numbers in both positively and negatively reacting animals, as well as in animals from which abortion bacilli were obtained by cultural or inoculation methods and in animals from which no microorganisms were obtained by such methods. In spite of their close resemblance to abortion bacilli, the author is not yet in a position to say that they are microorganisms. Their presence is associated with well-marked granular degeneration and necrobiosis of the epithelium.

Studies of the evolution and involution of the uterus led the author to believe that the changes in the placenta are continuously progressive until approaching parturition, and that eroded areas of maternal tissue may be found at any stage of pregnancy, such areas possibly favoring the invasion of the maternal tissues by bacteria already present or gaining entrance to the uterus at any stage of pregnancy.

[Studies on bovine infectious abortion at the Michigan Station], I. F. HUDDLESON (*Michigan Sta. Rpt. 1923, pp. 191-204*).—Studies of different problems in connection with bovine infectious abortion are reported as follows:

A serological study of several strains of Bacterium abortus (Bang).—In this study antigens were prepared from 21 strains of *B. abortus* from various sources, generally the same as those of a previous study (*E. S. R.*, 47, p. 584), and used in agglutination tests with 15 different bovine sera, 14 of which were from animals which had aborted from a natural infection and 1 from an animal which had a negative history of infection.

No significant differences were noted in the agglutinability of the different strains. One of the sera proved to have proagglutinating properties differing but little in degree with the different antigens. On lowering the density of the antigens the dilution of the serum in which proagglutination occurred was increased, but on increasing the density to a certain degree complete agglutination occurred.

The influence of different preservatives on the agglutinability of B. abortus.—To a series of antigens suspended in physiological salt solution were added phenol 0.5 per cent, tricresol 0.1, formalin 0.5, and ether 0.5 per cent. After having stood in the ice box for 24 hours, the preparations were used for agglutination tests with 28 unheated sera. The addition of phenol, formalin, and ether in the amounts given had no effect on agglutinability, but tricresol inhibited clumping completely or caused zone agglutination. It is noted also that the formalin in higher concentrations will produce the same effect.

The treatment of bovine infectious abortion with collargol.—To test the value of collargol for the destruction of *B. abortus* in infected animals, two groups of dairy cows were used. In the first group of 16, 5 gave positive blood tests, including 2 which had aborted previously. The 5 reacting animals were given intravenous injections of 20 cc. each of a 2 per cent aqueous solution of collargol. Two of these animals aborted subsequently, and all gave positive blood reactions when tested about 5 months after the treatment. In the second group of 21 dairy cows, 10 gave positive reactions, including 5 which had aborted previously. The 10 reactors were given 3 injections at 2-month intervals of the same amount of collargol as used in the first experiment. A considerable reaction was noted at the end of the second and third tests. Blood tests before each of the injections showed no change in reaction, and

one of the treated animals aborted. It is concluded that collargol is not only of doubtful value in the treatment of infectious abortion, but that its continued use is injurious.

The effect of a partial atmosphere of carbon dioxide gas on the bacteriological and pathogenic properties of B. abortus.—In view of the fact that the H-ion concentration of fetal fluids at different periods of gestation ranges between pH 6.6 and 7 and the carbon dioxide tension by volume between 10 and 15 per cent, and that similar values are obtained with freshly drawn milk, it was considered of value to determine the influence of such a tension of carbon dioxide on the pathogenic, agglutinating, and morphological characteristics of *B. abortus*.

Two nonpathogenic and two pathogenic strains were grown on liver agar pH 6.6, in an anaerobic jar in which 10 per cent of the air was replaced by carbon dioxide. The cultures were incubated at 37° C. for 24 hours, transplanted, and incubated as before for 50 days with the pathogenic and 100 days with the nonpathogenic strains. Each transfer was tested on guinea pigs to detect changes in pathogenicity, and frequent agglutination and growth tests were made. There was no change in the pathogenicity of any of the strains tested nor in the agglutinability or morphology of the organisms.

Studies relating to the immunology of bovine infectious abortion, J. M. BUCK and G. T. CREECH (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 607-642).—In these studies reported from the Bureau of Animal Industry, U. S. D. A., two methods were used. In one a limited number of animals from a selected stock in which infectious abortion had not been introduced was used for attempts at immunization with living abortion vaccine and abortion bacterin, and the work was checked at frequent intervals by serological tests and cultural and guinea pig inoculations of the milk and uterine materials. In the other use was made of infected herds in which some of the animals were subjected to immunizing treatment and the rest left as controls. In this method bacteriological studies could not be made as thoroughly as in the other method.

In the experiments with selected stock, 18 heifers and 5 cows were selected from stock in which no infectious abortion had occurred and in which negative reactions were obtained with the complement fixation and agglutination tests. Eight heifers and 3 cows which were not pregnant received subcutaneous injections of abortion vaccine and 4 heifers abortion bacterin, and 6 heifers and 2 cows were used as controls. The dose of vaccine was 20 cc. of a suspension of live bacteria averaging approximately one billion organisms per cubic centimeter. In general one inoculation was given. Of the animals receiving bacterin, 2 heifers were given 2 and 4 doses, respectively, before being bred, and 5 doses in all before being subjected to infection. The doses were given at monthly intervals and continued after infection. The dosage and strength of the bacterin were the same as of the unheated vaccine. One heifer was treated bimonthly with half this dose, receiving 2 injections before and 7 after exposure, and the fourth 7 bimonthly injections of 20 cc., 2 of which were before exposure but after breeding. The exposure consisted in feeding from 5 to 60 cc., diluted with from 50 to 100 cc. of physiological salt solution, of the stomach contents of aborted fetuses known to contain *Bacterium abortus*.

Of the group in which live vaccine was used, 10 of the 11 vaccinated animals gave birth to living calves. One of these was at the end of 229 days, and from the uterus of this cow, which was slaughtered 10 days later, *B. abortus* was isolated. The one aborted fetus also contained *B. abortus*, but its presence could not be demonstrated in the placentas or uterine fluids of any of the

other animals. In the bacterin-treated group, 2 heifers produced living calves at 282 and 273 days and the other 2 dead calves containing *B. abortus*. Seven of the 8 controls aborted, and *B. abortus* was isolated from the fetuses, placentas, and uterine fluids of all 8. Seven of the vaccinated animals were carried safely through a second and 4 through a third gestation period with similar exposure each time. The protection shown by 2 of the bacterin-treated heifers did not last through the second gestation period.

Bimonthly applications of the serological tests showed a decrease in agglutinins and complement-fixing bodies, beginning soon after vaccination and continuing until negative.

In connection with this phase of the investigation, studies were made of 12 cows which had previously aborted and from which *B. abortus* had been obtained, but all of which were eventually successfully bred. After breeding, the milk from 8 failed to produce abortion disease in guinea pigs. Eleven of the cows were then subjected to infection as in the above study and 10 subsequently calved normally. Eight of these, comprising those whose milk was negative, gave negative tests for *B. abortus* in the uterine fluids and placentas.

In a herd consisting of 1,500 head of dairy cattle in which the disease had been prevalent for a number of years, 772 animals were vaccinated and compared with 369 controls. During the first gestation period 13.1 per cent of the successfully bred vaccinated animals and 17.6 per cent of the controls aborted. During the second gestation period 10.2 per cent of 311 vaccinated animals and 14 per cent of 142 controls aborted. When compared as to serological tests, the heifers reacting negatively to the agglutination test appeared to derive the greatest amount of benefit from the vaccination. A comparison of the agglutination results with abortions indicated that approximately 60 per cent of the abortions were induced by other factors than *B. abortus* infection. In noting this, the danger is pointed out of drawing erroneous conclusions as to the value of immunizing agents in infectious abortion unless efforts are made to distinguish between abortions caused by *B. abortus* and other types.

The results as a whole are thought to demonstrate that immunity to *B. abortus* infection is possible in susceptible animals which have been vaccinated before conception with living abortion bacteria and in some cases in cows that have recovered from an attack of the disease. The decrease in the agglutination values is thought to indicate that such vaccination does not result in permanent infection. Whatever immunity is secured by treatment with abortion bacterin is thought to be limited and transitory. The possibility of causing permanent infection is thought to be greater when the vaccinated animals have functioning udders. Vaccination of abortion infected animals, as well as of those which have overcome the infection, is thought to be valueless.

Infectious abortion of cattle [trans. title], G. MOUSSU (*Rec. Méd. Vét.*, 100 (1924), No. 11, pp. 321-329, pls. 2).—In this general discussion of infectious abortion of cattle the opinion is advanced that the abortions are often the result of a diseased condition of the placenta rather than a real infection of the aborting cow, and that it is on this account that immunization is so difficult. The paper is illustrated by two colored plates showing fetuses covered with diseased membranes.

The experimental transmission of swamp fever or infectious anemia by means of secretions, J. W. SCOTT (*Wyoming Sta. Bul.* 138 (1924), pp. 17-62, pls. 11, figs. 4).—This is a report of investigations giving particular attention to the nasal and eye secretions, conducted in continuation of those

previously noted (E. S. R., 48, p. 283), which showed certain biting insects to transmit the infection.

Experiments with five horses, reported in detail, have led to the conclusion that infectious anemia may be transmitted by the subcutaneous inoculation of infective nasal secretion, the disease having been successfully transmitted to one horse and probably to a second. It may be transmitted by douching the nasal cavities with nasal washings from an infected horse, this method having succeeded with one horse, but having failed with another. An attempt to transmit the disease by the subcutaneous inoculation of filtered nasal washings from an infective source resulted negatively in the one horse experimented with.

In an experimental attempt to transmit the disease by means of eye secretions, in which a sixth horse was used, the animal either resisted the invasion of the virus or else tolerated its presence in the eye to such an extent that it failed to produce the disease, thus failing to confirm the claim of Lührs in 1919 that the virus is present in the eye secretion.

In an experiment with a seventh horse, two lots of extracts of *Tabanus septentrionalis* collected 0.5 mile or more from any pasture which contained horses, were made and both subcutaneously injected into a horse. One consisted of six flies macerated in 25 cc. of normal saline, the other of four flies in 20 cc. of normal saline. The results indicate that tabanids do not naturally harbor the virus of swamp fever.

Two cases of apparent spontaneous origin, which developed among 80 horses soon after the 2 animals had been introduced into the experimental lots, are next considered. Both of these animals appeared in good health and free from disease at the time purchased, but certain chronic carriers show, even after the most careful examination, little or no evidence whatever of infectious anemia.

In experiments with pregnant mares and their offspring severe onsets of fever during pregnancy produced abortion in three cases.

A study of the literature and the results of experiments have led the author to conclude that the virus of swamp fever is commonly present in not less than four excretions or secretions from infected horses, namely, the urine, nasal secretions, milk, and the eye secretion. Transmission experiments with saliva, sweat, and feces have so far given negative results. While a pathological condition in the lining of the alimentary canal may occasionally allow the escape of blood or the exudation of bloody serum which contains the virus, such presence in the feces would be of a purely accidental character.

A new nematode, *Cylindropharynx ornata*, from the zebra, with keys to related nematode parasites of the Equidae, E. B. CRAM (*Jour. Agr. Research* [U. S.], 28 (1924), No. 7, pp. 661-672, figs. 8).—Under the name *C. ornata*, the author describes and illustrates a new species of nematode collected from the feces and at post-mortem of *Equus grevyi*, received at Bethesda, Md., from Abyssinia. This is followed by a key to the genera and keys to the species of Strongylidae of the horse, donkey, mule, and zebra. *Strongylus* is represented by 4 species, *Triodontophorus* by 5 species, *Gyaloccephalus* by 2 species, *Oesophagodontus* by 1 species, *Poteriostomum* by 3 species, *Craterostomum* by 3 species, *Cylindropharynx* by 4 species, *Cylicotoichus* by 1 species, *Cylicobrachytus* by 2 species, *Cylicocercus* by 8 forms, *Cylicodontophorus* by 4 species, *Cylicostomum* (sens. str.) by 7 forms, *Trichonema* by 10 forms, and *Cylicostephanus* by 5 species. Additions to the literature following the preparation of this paper are briefly referred to in an addendum, and a list of 8 references to the literature is included.

Limberneck or botulism in chickens, W. T. JOHNSON (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 4, pp. 84, 85, figs. 2).—A brief practical account of this disease of chickens and the treatment applicable.

RURAL ENGINEERING

Research in agricultural engineering, 1923, R. W. TRULLINGER (*Agr. Engin.*, 5 (1924), Nos. 5, pp. 107-111; 6, pp. 133, 134; 7, pp. 160-162, 165).—This is a summary of the more prominent features of agricultural engineering experimentation and research completed, in progress, or in process of formulation during the year 1923 at the State agricultural colleges and experiment stations, at certain other State, Federal, and private institutions, and at certain foreign agricultural and engineering institutions.

Report of the section of farm mechanics [at the Michigan Station], H. H. MUSSELMAN (*Michigan Sta. Rpt.* 1923, pp. 245-248, figs. 3).—A brief description of the investigational work at the station in farm structures, drainage, and land clearing is given, together with illustrations of details of a new piggery.

Soil erosion as a research problem, W. H. MCPHEETERS (*Agr. Engin.*, 5 (1924), No. 7, pp. 158-160).—In a contribution from the Oklahoma College an analysis is given of the research features involved in a study of soil erosion. It is concluded that the phases of soil erosion requiring research treatment are the value of humus in soil in retarding soil erosion, the proper grading of terraces for different soils and land slopes, the comparative efficiencies of variable and constant terrace grades, the fall between terraces for different slopes, the amount of soil removed per unit of rainfall on various soil types and land slopes, and the value of terracing on the conservation of moisture.

Experiments in plowing cut over land (*Agr. Engin.*, 5 (1924), No. 6, pp. 127, 138).—The results of a series of experiments conducted at the Michigan Experiment Station on the effectiveness and relative efficiency of different types of tractors and breaking plows on rough hardwood land as compared with the usual team and hand plow breaking are briefly reported.

It was found that even with a small 2-plow tractor, single bottom breakers were available which did much better and cheaper work than was possible with the ordinary team methods. To effect a good quality of breaking on such soil it was necessary for a plow to have a long and flexible hitch between the plow and tractor, a long and wide moldboard with a quick curve, a long land side, a standing knife colter, and plenty of clearance in the throat. Only one bottom could be successfully pulled on a good job of breaking, regardless of the size of the tractor. Tractor breaking plows left the ground more completely turned over and leveled than the other methods. Tracklaying tractors had a certain advantage in getting over extremely rough ground with a minimum loss of time, but wheel tractors had the advantage of comfort for the operator. The advantage of time saving by the former types apparently did not have much effect on the final cost per acre of breaking.

An investigation of the fatigue of metals, H. F. MOORE and J. B. KOMMERS (*Ill. Univ., Engin. Expt. Sta. Bul.* 124 (1921), pp. 185, figs. 46).—Studies of the properties of ferrous metals, such as are used in the moving parts of machinery and of varying chemical and physical composition, to determine especially the influence of repeated stress and reversal of stress upon fatigue are reported.

For the metals tested under reversed stress, a well-defined critical stress was observed at which the relation between unit stress and the number of reversals necessary to cause failure changed markedly. Below this critical stress the

metals withstood 100,000,000 reversals of stress, and, so far as can be predicted from test results, would have withstood an indefinite number of such reversals. The name endurance limit has been given to this critical stress.

In the reconnaissance tests made in the field of ferrous metals, no simple relation was found between the endurance limit and the elastic limit, however determined. The ultimate tensile strength seemed to be a better index of the endurance limit under reversed stress than was the elastic limit. The Brinell hardness test seemed to furnish a still better index of the endurance limit. Elastic limits determined from compression tests and torsion tests gave no better index than did those from tension tests.

The single-blow impact tests (Charpy tests) and the repeated impact tests did not furnish a reliable index for the endurance limit under reversed stress of the ferrous metals tested. Accelerated or short-time tests of metals under repeated stress, using high stresses and consequent small numbers of repetitions to cause failure, are not considered reliable as indexes of the ability of metal to withstand millions of repetitions of low stress. The endurance limit for the ferrous metals tested could be predicted with a good degree of accuracy by the measurement of rise of temperature under reversed stress applied for a few minutes.

Abrupt changes of outline of specimens subjected to repeated stress greatly lowered their resistance. Cracks, nicks, and grooves caused in machine parts by wear, by accidental blows, by accidental heavy overload, or by improper heat treatment may cause such abrupt change of outline. Shoulders with short-radius fillets are a marked source of weakness. Poor surface finish on specimens subjected to reversed stress was found to be a source of weakness. This weakness may be explained by the formation of cracks due to localized stress at the bottom of scratches or tool marks.

Stress above the endurance limits, due to either a heavy overload applied a few times or a light overload applied some thousands of times, was found to reduce somewhat the endurance limit of two ferrous metals tested. In none of the ferrous metals tested did the endurance limit under completely reversed stress fall below 36 per cent of the ultimate tensile strength, and for only one metal did it fall below 40 per cent, while for several metals it was more than 50 per cent. However, these metals were to a high degree free from inclusions or other internal defects. The specimens had no abrupt changes of outline and had a good surface finish.

The influence of subjecting steel to a stress beyond the yield point was greater on the static elastic tensile strength than on the endurance limit, although some increase was observed for 0.18 carbon steel with polished surface after being stretched well beyond the yield point. Annealing of commercial cold-drawn screw stock was found to lower its endurance limit somewhat less than it did its static elastic strength.

The results as a whole are taken to indicate the effectiveness of proper heat treatment in raising the endurance limit of the ferrous metals tested.

Four appendixes are included.

An investigation of the fatigue of metals, H. F. MOORE and T. M. JASPER (*Ill. Univ., Engin. Expt. Sta. Bul. 142 (1924), pp. 88, figs. 22*).—This progress report is a continuation of the above investigation of the fatigue of metals, which was organized in 1919 and has been carried on at the University of Illinois in cooperation with the National Research Council, Engineering Foundation, and several manufacturing firms.

The results have yielded evidence of the existence of an endurance limit for wrought ferrous metals. The tests not only failed to give evidence of

damage to the metal by millions of cycles of understress but actually showed an increase of resistance to further repeated stress. This strengthening effect was most marked for those steels which are susceptible of improvement in static strength by cold working. Repeated stress at or below the original endurance limit of a wrought ferrous metal was found to raise the endurance limit for that metal. A few cycles of repeated stress above the original endurance limit lowered it. It was found that a wrought ferrous metal injured by such overstress may have its strength partly, but rarely wholly, restored by polishing its surface or by repeated stress below the endurance limit. The static strength of a wrought ferrous metal was also increased by repeated stress below the endurance limit.

Under cycles of alternate axial tension and axial compression, specimens of wrought ferrous metals gave endurance limits averaging 64 per cent of the endurance limits for the same metals under cycles of reversed flexural stress. It is recommended tentatively that the endurance limit of wrought ferrous metals under reversed axial stress be considered as 60 per cent of the endurance limit under reversed flexural stress.

The static tensile strength and the endurance limit of wrought ferrous metals were found to be lower for specimens tested across the direction of rolling than for specimens tested along the direction of rolling. Test results for a number of specimens of wrought iron and of 0.37 per cent carbon steel indicated that the effect of the direction of rolling on the endurance limit is fully as great as the effect on the static ultimate tensile strength.

Test results for 48 specimens of 0.37 per cent carbon steel, cut from a 4-in. billet and subsequently heat treated, indicated some relative improvement of the strength of specimens tested across the direction of rolling as compared with specimens tested along the direction of rolling.

The endurance limit and the static strength of very low carbon steel were raised appreciably by heat treatment, including a water quench, although the effect was much less marked than in the case of high carbon steels and of alloy steels. The endurance limit for cycles of reversed shearing stress for wrought ferrous metals was found to be about 53 per cent of that for cycles of reversed flexure. The data indicate further that for shearing stress the endurance limit of wrought ferrous metals for cycles of stress varying from zero to a maximum is nearly twice the endurance limit of completely reversed stress.

A statement of a theory of the fatigue of metals, which extends and modifies the generally accepted theory, is summarized in detail.

A bibliography of 55 references to the literature is appended.

Electricity in agriculture abroad, R. A. LUNDQUIST (*Agr. Engin.*, 5 (1924), No. 7, pp. 151-154, fig. 1).—In a contribution from the U. S. Department of Commerce a review is given of the status of the agricultural use of electricity in European countries.

The 30x30 Missouri poultry house, H. L. KEMPSTER (*Missouri Sta. Circ.* 129 (1924), pp. 8, figs. 6).—General information, working drawings, and a bill of material for the construction of the 30 by 30 Missouri poultry house are presented.

The relation of farm animals to proper ventilation of barns, M. A. R. KELLEY (*Agr. Engin.*, 5 (1924), No. 7, pp. 155-157, fig. 1).—In a contribution from the U. S. D. A. Bureau of Public Roads a brief analysis is given of the factors entering into the ventilation of animal shelters. It is concluded that the basis of ventilation is essentially the control of temperature and humidity and the maintenance of air circulation. In this connection the necessity of knowing more about the heat production of various farm animals under differ-

ent conditions is emphasized. A list of the problems to be solved in the ventilation of animal shelters is suggested.

Farm plumbing, G. M. WARREN (*U. S. Dept. Agr., Farmers' Bul. 1426 (1924), pp. II+34, figs. 43*).—Practical information on the planning and installation of plumbing in the farmhouse is presented.

Water purification by means of lime in connection with the drinking water question in the Dutch East Indies, II [trans. title], J. SMIT (*Centbl. Bakt. [etc.], 2. Abt., 59 (1923), No. 12-16, pp. 322-333*).—In continuation and extension of work previously reported (*E. S. R., 47, p. 288*), studies are reported which showed that treatment of water with caustic lime, followed by filtration through sand or filter paper, removed the pathogenic organisms. Slow sand filtration, while reducing the number of organisms, was not as effective in this respect as rapid sand filtration. The addition of enough lime to produce alkalinity is necessary for good results.

The very turbid waters of Java were clarified and rendered very low in bacterial content by this process. Sedimentation before filtration was found to be unnecessary for good results. Cholera and typhoid organisms were removed from such water without difficulty. The action of alum was less favorable than that of lime, and it was useless for the removal of pathogenic organisms. Further experiments with dilute lime water showed that the alkalinity produced was very toxic to both pathogenic organisms and *Bacillus coli*. This is considered to account for the superiority of lime over alum as a water purification medium.

A process combining precipitation for six hours with filtration through fine silica and a thin sand layer produced a filtrate corresponding to good bath water, which had the additional property of self-purification owing to its alkalinity.

"Bacteriophage" and self-purification of water [trans. title], P. C. FLU (*Centbl. Bakt. [etc.], 2. Abt., 59 (1923), No. 12-16, pp. 317-321*).—Studies to establish the presence and manner of action in water of so-called bacteriophage or liquid substances imparting the property of self-purification are reported.

The results showed that these substances, if they exist, are of very little importance in the self-purification of water, but that the protozoa are the main controlling factors. When the protozoa were killed with potassium cyanide, self-purification of the water did not take place.

Some sewage disposal investigations, E. A. STEWART (*Agr. Engin., 5 (1924), No. 6, pp. 131, 132, figs. 3*).—Studies conducted at the Minnesota Experiment Station on the design of a homemade siphon, of inlets to septic tanks, of tanks to give a clear effluent, and of proper methods of disposal of the effluent are briefly reported.

The sewage, when carried in through a simple elbow or behind a baffle board, produced a great deal of agitation in the tank, and the sludge was stirred up and very unevenly distributed. The use of an elbow and tee, with the points of the tee turned sidewise, and of a current breaker chamber made quite satisfactory inlets. The use of a tank and disposal well is said to have given considerable satisfaction.

RURAL ECONOMICS AND SOCIOLOGY

The agricultural crisis, 1920-1923, R. R. ENFIELD (*London and New York: Longmans, Green & Co., 1924, pp. XI+211, fig. 19*).—The agricultural crisis of 1920 and 1921 in both the United States and Great Britain is described.

In outlining some of the causes for it the upward price movement between 1913 and 1919 is analyzed. It is said that the position of the United States in 1919 was characterized by an unprecedented demand for goods and an inflow of gold and a banking system which allowed very great expansion of credit and of currency so long as its policy was dictated solely by consideration of the statutory reserve ratios. The turning point came in May, 1920, and the downward price movement spread from the United States to England, Europe, and the colonies. Agriculture like every other industry was caught. By December, 1921, the level of agricultural prices had fallen by 33 per cent. The price movements of these years are analyzed in terms of costs of agricultural production and the relative costs of arable and pasture farming in Great Britain, and the relation between the movement of agricultural prices and that of general wholesale prices is traced.

Fluctuations in the prices of agricultural products are held to be due partly to truly monetary causes and partly to alterations in supply and demand for farm produce, depending on seasonal conditions or other causes which are not readily susceptible to direct control. Some of the means of preventing price fluctuations by legislation, collective action, and organized and cooperative marketing are set forth.

Outline of projects and plan of work of the cost of production division, South Dakota Department of Agriculture (*S. Dak. Dept. Agr. Circ. 1* (1922), pp. [1]+20).—Nine projects representing the major part of the work to be undertaken during the first year by this newly established agency are outlined.

Annual report [of the] cost of production division, South Dakota Department of Agriculture [1922], F. M. BYRNE (*S. Dak. Dept. Agr. Cost Prod. Div. Ann. Rpt. [1922]*, p. 53).—The first report of the cost of production division noted above is submitted here, and results of investigations and data available are presented in preliminary form.

A handbook on South Dakota farm production costs, M. R. BENEDICT (*S. Dak. Dept. Agr. Circ. 4* (1923), pp. 40).—Data are summarized from records secured by cooperation with 227 farmers in South Dakota in 1921 and with 113 in 1922.

Preliminary report on studies in developing farms on western South Dakota ranges, C. G. WORSHAM (*S. Dak. Dept. Agr. Circ. 5* (1923), p. 44).—Data for the years 1921 and 1922 are presented supplementing the circular previously noted (*E. S. R.*, 48, p. 593).

The average farm receipts were \$846 higher in 1922 than in the earlier year and the expenses \$107 lower. In 1922 there were only 19 out of the 66 farms that did not make a positive labor income, whereas 47 of the 61 studied in 1921 failed to do so.

The cost of producing apples in Minnesota, 1916–1920, W. G. BRIERLEY, W. J. KOPPEN, and G. A. POND (*Minnesota Sta. Bul. 209* (1924), pp. 7–44, fig. 15).—A number of commercial orchards in Minnesota were visited by field men, and data were obtained on a 5-year basis, although some records cover only three years. The earlier records taken in 1918 and 1919 were supplemented by additional data relating to yields and prices up to and including 1920. Sixty-four orchards were included in the final survey, aggregating 487.4 acres, of which 407.4 acres were of bearing age. The average value per acre of a bearing orchard in this study was \$510, and valuations ranged from \$150 to \$800. The average age of the orchards surveyed was 15.6 years, the range being from 8 to 36 years (on the basis of 1920). Only two were more than 25 years old.

The average total yield per acre was 149.8 bu., the range being from 31.2 to 400.6 bu. Of the average total yield, 135.8 bu. were packed and sold. In

12 well-managed orchards comprising 86 acres, the average yield was 254.2 bu. per acre, while in the 4 best orchards the average yield was 310.9 bu.

The average gross returns per acre amounted to \$215.99, ranging from \$23.75 to \$506.81, on the basis of 135.8 bu. of packed apples at \$1.53 per bushel, 2 bu. used at home at the same price, and 12 bu. of culls at 43 cts. per bushel. Nine of the better managed orchards showed gross returns of more than \$200 an acre, 9 others of more than \$300 an acre, 4 of more than \$400, and 1 of the maximum.

Common management practices are noted, and factors of cost are discussed under the heads of labor requirements, material costs, fixed costs, and overhead costs. Material costs, including the heavy package charge, constituted the largest cost group; fixed costs, including the charge for interest on investment, the next largest; and crop handling, maintenance, and overhead the next in order. With an average gross income of \$215.99 per acre and \$1.44 per bushel, there were average costs of \$125.20 and 84 cts. per acre and per bushel, respectively, including interest charges of \$32.31 per acre and 21.5 cts. per bushel, leaving an average net income of \$90.79 per acre and 60 cts. per bushel for the orchards surveyed. The owner did most of the manuring, pruning, and disposing of brush; approximately one-third of the mowing; one-fifth of the picking; four-fifths of the sorting and packing; and one-half of the hauling to market, the average owner having expended a total of 56.35 hours per acre in the various labor operations. At 25 cts. per hour this amount of time represents an income of \$14.09 per acre, which together with the interest charges noted and the net income gave an owner's average total income of \$137.19 per acre.

The cost of grazing. A. G. RUSTON (*Jour. Min. Agr. [Gt. Brit.], 30 (1924), No. 12, pp. 1119-1128*).—Results obtained in 1919 from an investigation of the grazing of 976 acres on 12 different farms in Yorkshire, England, are briefly presented. This amount of grassland carried an equivalent of one cow to 1.43 acres. The cost of grazing amounted to £3 8s. 8d. per acre, 16s. 5d. per sheep per year, and £4 18s. 5d. per cow per year. Assuming that the cows were on grass for 22 weeks during the year a figure of 4s. 6d. indicates the average cost of grazing per cow per week. Five-sixths of this figure, or £4 2s. 1d., as the cost of grazing a heifer amounts to 1s. 7d. per week during the whole year.

The total labor bill amounted to 6s. 10d. per acre for man labor and 3s. 5d. per acre for horse labor, these constituting 9.6 and 5.1 per cent, respectively, of the total costs. Approximately one full day's work per acre per man and one-half a full day's work for a horse were required annually at a total cost of 10s. 3d. per acre. The upkeep of fences, draining, and cutting thistles accounted for 54 per cent of the total cost and chain harrowing and rolling for 26 per cent, the remaining labor being required for the application of manures. Yearly variations and incidental expenses are noted.

For the year 1922-23 the average acreage cost of grazing amounted to £2 19s. 4d. and the average cost per cow equivalent to £4 6s. per year, the latter varying between £1 14s. 7d. and £8 4s. 4d. Some specific instances illustrating the factors influencing costs are recounted.

The financial progression of a ten-acre poultry plant. MR. and MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul., 12 (1924), No. 4, pp. 85-89*).—Charts have been worked out recommending a safe four-year plan of development for a poultry business on 10 acres or more, presumably intended for logged-off tracts where poultry must be the major project.

Investigations relative to the profits from Swiss agriculture for the crop year 1922-23, I, II [trans. title], E. LAUR ET AL. (*Landw. Jahrb.*

Schweiz, 38 (1924), Nos. 1, pp. 103; 3, pp. 253-363).—Returns for the current year are reported in two sections, continuing the investigations previously noted (E. S. R., 49, p. 389).

The land question in Finland [trans. title], C. METZGER (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 1 (1923), pp. 56-85, fig. 1*).—The author traces briefly the disturbances of the relationships between landowners and workers which arose out of the development of lumber industries and increased attention to lumber exports. The land question is held to be not so much one of the redistribution of land, however, as of the education of the peasants and the laboring classes. Recent legislation with regard to land distribution has been in two main directions, namely, the extension of the already established small holdings and new colonization on State and private lands, with State aid or under State direction. The land for settlement is to be supplied first from the State domain, and then by freewill sale of communal or private property, and last of all by expropriation by the State.

Land reform in the Republic of Czechoslovakia [trans. title], HOLLMANN (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 2 (1923), pp. 19-42*).—Land reform laws are regarded as political instruments in the struggle for Czech nationality in the republic. Laws and enforcing regulations are taken up separately in chronological order and classified according to their purpose, whether authorizing confiscation and setting the compensation or dealing with valuation plans, credit provisions, and the powers of administrative committees.

Agrarian reform in Rumania [trans. title], HOLLMANN (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 1 (1923), pp. 39-55*).—A historical account is presented of events and influences said to have brought about the land reforms of recent years, together with a statistical study of the reduction in grain production and exports. The decrease in acreage is attributed partly to the war and partly to the agrarian revolution which has increased the small peasant holdings. Surplus grain is not produced, for the peasant produces principally for his own individual needs and those of his business.

A study of farm labor in Seneca County, New York, R. L. GILLET (*N. Y. State Dept. Farms and Markets, Agr. Bul. 164 (1924), pp. 69, figs. 2*).—A farm labor study is discussed, in which over 200 farms in the southeastern part of Seneca County, N. Y., were visited and 199 usable records were obtained. Of the farms included in the inquiry, 64 were operated by tenants and 135 by owners.

The average hours of work per farm per year amounted to 5,899. The number of hours on farms operated by owners was higher than on those operated by tenants, particularly in winter. Over three-fourths of the farms reported between 3,000 and 8,000 hours of work. Of the total number of farms, 88 per cent were operated by a labor force including family labor of less than 2.5 man equivalents per farm. Of all the farm boys between 8 and 15 years old, 69 per cent, and of the boys and men above 15 years old, 98 per cent did farm work at home. Of all the boys attending schools, three-fourths did some farm work. The average number of hours of work per year for all the boys between the ages of 8 and 19 years who worked and attended school was 758. The hired laborers were largely obtained locally.

Of the net number of hours of labor, 62 per cent was done by the operators, 12 per cent by sons, and 12 per cent by other members of the family. The farm operators averaged 3,370 hours each of farm work per year, a few being employed in other work part of the year. The men hired by the month averaged 1,379 hours and the day men 197 hours each. A considerable variation

in the seasonal distribution of the work done by the different classes of workers is noted, that of the operators being most evenly distributed. Farm operators are the only class of workers working an average of as much as 300 week days during the year. They also worked an average of 10.7 hours per day throughout the year, a longer time than any other class. Farmers worked longer hours on the larger farms, varying from an average of 8.7 hours per day on farms with 20 or fewer acres in crops to 11.3 hours in those with 121 acres or over. Wives worked 1.9 hours per day at farm work. Exchange work amounted to 112 hours per farm.

Two-thirds of the pay of farm labor was in cash and one-third in privileges, the latter consisting principally of the value of meals and of board and lodging. Wages of monthly men were usually calculated on the basis of 26 working days per month, although some employers disregarded occasional lost days. Cash bonuses ranging from \$4 to \$7 a month were paid at the end of the season to three men.

A discussion of economic and social factors and relationships concludes this report.

Insolvencies among farmers, A. W. ASHBY (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 2, pp. 130-132).—Personal causes are said to be predominant in cases of bankruptcy among farmers. These and general economic causes are classified and discussed briefly. Some data are given with reference to the number of insolvencies among farmers in Great Britain in recent years.

How to use the new Agricultural Credits Act of 1923, H. MYRICK (*Chicago: Phelps Pub. Co.*, 1923, pp. 96, pl. 1, fig. 1).—A manual including the official text of the Agricultural Credits Act approved March 4, 1923, is presented for farmers, cooperators, bankers, and investors.

The interests of the farmer in relation to taxation and national indebtedness, H. C. MCKENZIE (*Acad. Polit. Sci. New York, Proc.*, 11 (1924), No. 1, pp. 116-123).—Agriculture as a whole is said to be in the most desperate financial condition ever known in the United States, and taxation, both State and national, is held to be among the chief causes. The general property tax is said to hit the farmer hardest. The way in which State and local taxes have increased is illustrated with examples from New York State. It is held that more money should be raised by income and corporation taxes, and also a constantly enlarging consuming power secured not by lowering the income taxes of a few wealthy men but by cutting the consumption taxes.

Farmers' Market Bulletin, [October, 1924] (*North Carolina Sta. Farmers' Market Bul.*, 11 (1924), No. 72, pp. 8).—The United States grades for sweet potatoes recommended by the U. S. Department of Agriculture are described, and the usual partial list of products which farmers have for sale is given.

Grain futures: Daily data (*U. S. Dept. Agr., Statis. Bul.* 6 (1924), pp. 25).—Statistical information has been compiled and tabulated under the direction of J. W. T. Duvel by the Grain Futures Administration, U. S. D. A., in order to show the volume of trading on each of the seven principal grain futures markets in the United States for the years 1921 to 1923, inclusive. The trading on the Chicago Board of Trade, which during that 3-year period amounted to 87.65 per cent of the total for the seven markets, is given on a daily as well as on a monthly and yearly basis for the period January 3, 1921, to May 31, 1924, inclusive, with summaries. The data have been compiled from reports made to the U. S. Bureau of Internal Revenue by each of the members of the clearing house of the Chicago Board of Trade and from daily reports made to the Grain Futures Administration.

Grading, packing, and handling head lettuce in New York State, F. O. UNDERWOOD (*N. Y. Agr. Col. (Cornell) Ext. Bul. 87 (1924), pp. 10, figs. 3*).—This discussion covers the status of the lettuce industry, harvesting, grading, packing, and the need of developing new markets.

Review of existing methods of marketing of Queensland fruit, W. RANGER ET AL. (*Brisbane: Queensland Prod. Assoc., Council Agr., 1923, pp. IV+87, pl. 1, figs. 3*).—A special committee of the Council of Agriculture for Queensland makes its report, reviewing methods of transportation of fruit and the principal fruit markets, together with a number of producers' organizations and exporting companies. It is concluded that the industry is disorganized and generally unsatisfactory, and proposals are made to provide for the control of the fruit up to the point of wholesale marketing and the establishment of growers' retail organizations on a voluntary basis.

Thirty-fifth annual wool review, WINCHCOMBE, CARSON, LTD. (*Sydney: [Authors], 1924, pp. 32*).—This is the usual annual review of the wool situation (*E. S. R.*, 50, p. 369) and includes a brief discussion of the meat trade and fat stock markets.

The regulation of the selling price of agricultural products, Italy, C. MOSCA (*Réglementation des Prix de Vente des Produits Agricoles, Italie. Rome: Inst. Internatl. Agr., Serv. Statis. Gén., 1923, pp. 79*).—A short historical résumé is given noting in chronological order measures adopted by the State up to 1921 and in some cases including 1922 in an attempt to regulate the selling prices of agricultural products, prevent speculation, and offer bonuses or guaranties. Five chapters deal with general measures relating to maximum prices and the prices fixed on cereals, other vegetables, food products, livestock and dairy products, and nonalimentary commodities, such as hay and straw, hides, linen, and textile fabrics. Miscellaneous measures for relief and control are noted. This is the first of a projected series of inquiries into the measures adopted in various countries for the intensification for agricultural production.

The livestock crisis in the La Plata region as an impetus to an agricultural revolution in Uruguay [trans. title], A. BOERGER (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 2 (1923), pp. 84-105, fig. 1*).—A marked decrease in the prices received for livestock and livestock products exported from Uruguay in recent years is pointed out, together with the necessity of developing an intensive system of agriculture. Legislation is being enacted dealing with the opening up of agricultural lands. One important difficulty in the colonization of Uruguay is said to be the fact that there are no State lands available as there are in certain of the neighboring South American countries.

A bill creating the national colonization fund [trans. title], E. A. CONI (*Rev. Facult. Agron. y Vet. Buenos Aires, 4 (1923), No. 2, pp. 273-396*).—This account of the need for agricultural colonization in Argentina is prefaced by a discussion of the unsatisfactory state of agriculture there, particularly with respect to cereal production, and some of the causes for it are analyzed. Possible remedies in the way of public and private colonization projects are set forth. The more important schemes which have been drawn up since 1902 are systematically reviewed, giving special attention to the colonization and credit undertakings of the National Mortgage Bank. The complete text is given with comment of a bill creating a national colonization fund. Tabulated statistical data conclude the paper.

The explanation for the Swiss agricultural crisis and the means for the alleviation of it [trans. title], O. HOWALD (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 2 (1923), pp. 42-57, fig. 1*).—This

is a discussion of the industrial structure of the country in general and of its agricultural relationships in particular. The extent of and yields from agricultural industries are set forth statistically for a period of years up to 1921. The relief measures suggested are an increase in yields, a decrease in expenditures, and a higher level of prices for agricultural products.

Price currents and the economic position of German agriculture in the postwar period [trans. title], SAGAWÉ (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 2 (1923), pp. 3-18*).—General consideration is given to the price situation in Germany in the period 1920-21 to 1922-23, inclusive, discussing index numbers of yields and gross and net income from agricultural products by provinces and according to types of soil. Detailed information is presented on the basis of bookkeeping records of 60 farm businesses in central Germany in 1921-22. Tabulations are made in terms of paper marks and the fixed mark.

The generally unfavorable situation in 1920-21 is distinctly brought out. An improvement in both yields and prices is shown for 1921-22, however. Taking the year 1922-23 as a whole the gross yields averaged somewhat lower than in the preceding year, but fertilizer prices were somewhat lower also. Certain products, especially potatoes, sugar, and milk, were delivered at prices lower than the cost of production. The survey of individual enterprises is said to bring out the influence of the operator in the success or failure of the business, especially from the point of view of management.

[Agricultural statistics for the United Kingdom, 1906-1920] (*United Kingdom Statis. Abs., 67 (1906-1920), pp. 262-275*).—Tabulated data are summarized showing prices, the acreage of crops and number of livestock, and the estimated total produce of the important products in Great Britain, Ireland, and the United Kingdom, continuing the series of reports previously noted (E. S. R., 46, p. 696).

Agriculture in Denmark [trans. title] JACOBSEN (*Ber. Landw. Reichsmin. Ernähr. u. Landw. [Germany], n. ser., No. 2 (1923), pp. 58-83*).—A statistical summary is given of crop production and livestock raising, with descriptive notes on agricultural organizations.

[Agricultural statistics for the Netherlands] (*Jaarc. Koninkr. Nederlanden, Rijk Europa, 1922, pp. 182-195*).—Statistics for 1922 are presented by provinces, together with some comparisons with earlier years, continuing the series previously noted (E. S. R., 49, p. 296).

Agriculture and industry in the economic life of Finland, M. KOVERO (*L'Agriculture et l'Industrie dans la Vie Économique de la Finlande. Helsingfors: Govt., 1923, pp. 25*).—This is a statistical discussion in French setting forth developments in recent years.

Agriculture [in the southern territories of Algeria] (*In Les Territoires du Sud de l'Algérie.—II, L'Oeuvre Accomplie, 1903-1921. Algiers: Govt. Gén. Algérie, Dir. Ter. Sud, 1922, vol. 2, pp. 177-245*).—Notes are presented with reference to the general agricultural situation and the cultivation of specific products.

Agricultural statistics of India, 1921-22, D. N. GHOSH (*India Agr. Statis., 38 (1921-22), I, pp. [2]+IX+99, pls. 7; II, pp. [2]+V+83, pl. 1*).—Annual statistics, with brief analytical notes, continue the series of reports previously noted (E. S. R., 50, p. 693).

Quinquennial report on the average yield per acre of principal crops in India for the period ending 1921-22, D. N. GHOSH (*India Com. Intel. Dept., Quinq. Rpt. Av. Yield Princ. Crops India, 1921-22, pp. [2]+25*).—Returns from crops are summarized by provinces in this report, succeeding one previously noted (E. S. R., 40, p. 894).

Estimates of area and yield of principal crops in India, 1922-23, D. N. GHOSH (*India Com. Intel. Dept., Est. Area and Yield Princ. Crops India, 1922-23, pp. [2]+47, pl. 1*).—Annual statistics are presented continuing the series previously noted (E. S. R., 52, p. 95).

AGRICULTURAL EDUCATION

Report of the Commissioner of Education for the year ended June 30, 1924, J. J. TIGERT (*U. S. Bur. Ed., Rpt. Commr. Ed., 1924, pp. III+32, figs. 3*).—The operations of the division of rural education and of the service division touching upon home economics education during the year are briefly summarized in sections of this report.

Milpitas—a rural school project in teacher training, C. H. SMITH and LA R. OLVEY (*U. S. Bur. Ed., Rural School Leaflet 27 (1924), pp. 19, figs. 12*).—A school in the unincorporated village of Milpitas in the Santa Clara Valley, 7 miles from San Jose, Calif., was taken under the management of the San Jose State Teachers College and used as a training school for rural teachers. An account is given here of the reorganization, features of instruction, school spirit, and community undertakings of the school.

Significant historical attempts to introduce manual education into American schools (1629-1862), C. P. COATES (*Indus. Arts Mag., 13 (1924), No. 12, pp. 458-460*).—This follows an article previously noted (E. S. R., 52, p. 96), with a list of the readily available documents pertaining to schools which have tried the manual labor plan.

The Antioch adventure in home economics, J. E. TURNER (*Jour. Home Econ., 16 (1924), No. 11, pp. 611-616*).—The cooperative system of teaching home economics at Antioch College in Ohio is noted. Students spend alternate periods of five weeks each in college at study and in industry during the year; thus combining theory with practical experience.

The study and teaching of agricultural economics, A. W. ASHBY (*Jour. Min. Agr. [Gt. Brit.], 31 (1924), No. 3, pp. 236-242*).—It is pointed out that the first facilities for the study of agricultural economics in England were provided in 1913, when the Institute for Research in Agricultural Economics was established at Oxford by the university and the Ministry of Agriculture supported by the Development Commissioners. Before that time, however, some colleges and universities had been providing courses in economics for students in agricultural degree courses. The general scope of the study and teaching of agricultural economics is regarded as covering the factors in the internal management of the farm which determine the productivity of the enterprise and the remuneration of those who are engaged in it, whether workers, farmers, or landowners, and the external factors which determine the course of production which is possible or desirable and those which determine the prices of farm products. The study of economic farm management is said to be the most advanced in England. No attention has yet been paid to the study of rural sociology by any academic institution there, primarily because of the essentially industrial and urban character of the country as a whole.

[Agricultural and technical instruction in Ireland] (*Ireland Dept. Agr. and Tech. Instr., Ann. Gen. Rpt. 22 (1921-22), pp. 12-28, 63-79*).—Notes on progress during the year are presented continuing annual reports previously noted (E. S. R., 50, p. 394).

The development of the Hokkaido Imperial University (*Sapporo, Japan: Hokkaido Imp. Univ., 1923, pp. [2]+75+[3], pls. 4*).—The answers prepared by the special committee of the university in reply to a questionnaire received from the committee on intellectual cooperation of the League of Nations in

Geneva are published here, covering various phases of the history of the university, its present conditions, and its plans for the future.

The college of agriculture on the Island of Mauritius [trans. title] (*Rev. Agr. Maurice*, No. 7 (1923), pp. 41-48).—The course of instruction in agriculture leading to a certificate after two years' work and the three-year course leading to a diploma are outlined here.

[Agricultural lectures at the college of agriculture on the Island of Mauritius] (*Rev. Agr. Maurice*, No. 13 (1924), pp. 45-50).—A series of special lectures held between January and June, 1924, and covering general agriculture, the cultivation of sugar cane, rural sociology, animal husbandry and veterinary science, sugar technology, and agricultural chemistry, are noted.

Agricultural courses for normal college students at the Potchefstroom School of Agriculture (*Union So. Africa Dept. Agr. Jour.*, 9 (1924), No. 3, pp. 226-231).—A special two-months course for the training of teachers of agriculture in the Transvaal is described, and a proposed syllabus is drawn up for a one-year course in agriculture for normal college students.

A textbook of general botany, R. M. HOLMAN and W. W. ROBBINS (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1924, pp. IX+590, pl. 1, figs. 374).—This embodies the material of lectures in general botany attended by both agricultural and liberal arts students, and is designed to give a broad survey of the whole field in so far as possible within the limits of elementary courses. It is related to agricultural practices and problems wherever possible, and wide use is made of economic plants for illustrative material. The text is designed for a year's course, though it may be adapted to use in shorter courses.

Government publications useful to teachers, compiled by E. E. WINDES (*U. S. Bur. Ed. Bul.* 23 (1924), pp. [3]+34, figs. 26).—Bulletin series, annual reports, posters, exhibits, lantern slides, and other materials are listed according to the Government department preparing them, and the educational service of the American Red Cross and the Pan American Union are briefly set forth.

MISCELLANEOUS

Thirty-sixth Annual Report of the [Michigan Station, 1923], E. B. HILL ET AL. (*Michigan Sta. Rpt.* 1923, pp. 163-497, figs. 106).—This contains a financial statement for the year ended June 30, 1923; reports of the director and heads of departments on the work of the station during the year, the experimental features of which are for the most part abstracted elsewhere in this issue; and reprints of Special Bulletins 117 and 118 and Technical Bulletins 57-60, all of which have been previously noted.

Texas Agricultural Experiment Station system, B. YOUNGBLOOD (*Texas Sta. Circ.* 33 (1924), pp. 3-40).—This is a detailed description of the history, purpose, and work of the station, including a complete list of its publications and considerable statistical data relative to its personnel.

Bi-monthly Bulletin [of the Western Washington Station, November, 1924] (*Western Washington Sta. Bimo. Bul.*, 12 (1924), No. 4, pp. 77-96, figs. 4).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Tree Surgery, by H. D. Locklin, and Winter School for Farmers.

NOTES

Arizona University and Station.—Under an act of Congress approved January 9, 1925, the Secretary of the Interior is directed to sell to the board of regents at \$1.25 per acre a quarter section of land for use in educational and investigational purposes. The tract is located on the Yuma Mesa, and a part of it is already in use as a substation for subtropical horticultural work, 10 acres being planted to citrus fruits and about 5 acres each to grapes, figs, and miscellaneous subtropical fruits. The act provides that on failure at any time to use the tract for educational or investigational purposes title is to revert to the Federal Government.

Arkansas University and Station.—An appropriation of \$650,000 for new buildings during the next biennium has been made by the legislature, of which \$300,000 is to be used for a new building for the College of Agriculture. A grant of \$10,000 was also made for the establishment and maintenance of three substations, one to be devoted to cotton, one to rice, and one to truck crops.

Office facilities have been provided at the station farm which are expected to be of material convenience in the experimental work.

Connecticut State Station.—Dr. P. J. Anderson, research professor of botany at the Massachusetts Station, has accepted a position in charge of the Tobacco Substation at Windsor, beginning April 1. W. T. Mathis has been appointed assistant chemist in the analytical laboratory and George D. Scarseth assistant in soils.

Idaho Station.—Dr. W. B. Bollen, formerly research fellow in soils at the Iowa College, has been appointed assistant chemist vice Frank H. Collins, who has accepted a similar position in the department of agricultural chemistry in the Kansas College.

Kentucky Station.—Ethel L. Hopphan, serologist in the department of public service laboratories, resigned December 1, 1924, and Dr. M. L. Boevers, assistant in the department of veterinary science, on March 1.

New York State Station.—Several new varieties of fruit originated by the station have recently been made available to fruit growers through the New York State Fruit Testing Association, which now has a membership scattered through many States and Canada. Among the new varieties now being distributed are the Sweet Delicious, Red Astrachan, Red Spy, and Yellow Transparent No. 2575 apples; the Gorham, Pulteney, Bartlett No. 1619, and Cayuga pears; the Hall, Imperial, Epineuse, and Pacific plums; the Hunter nectarine, a smooth-skin peach; and the Wilma, a new Elberta-like peach.

An extensive pruning experiment with apples which has been in progress for more than 10 years indicates that apple trees which have been carefully selected and pruned when set in the orchard require very little pruning for several years, and usually do best when so trained that the lowest branches are not more than 20 in. from the ground. The portion of the experimental orchard which was lightly pruned contained trees which were for the most part stockier in trunks and branches, developed a greater bearing area, usually bloomed earlier in life and more profusely, and generally set fruit earlier and in greater quantity than did the trees that were heavily pruned, although heavily pruned trees of Baldwin, Boiken, Hubbardston, and Tompkins King have yielded more

fruit. The amount of pruning has apparently had no influence on the size, color, shape, time of maturity, or quality of the fruit.

The trees which were trained to low heads were from one to three years ahead of the high-headed trees in point of size and vigor within a few years after setting in the orchard. High-headed trees were also less stocky in trunk and branches with the result that they were twisted and bent badly by the wind. Low-headed trees had large bearing areas, and they were also more amenable to orchard operations, such as pruning, spraying, and harvesting the fruit. There seemed to be no difference between high- and low-headed trees so far as the practice affected any of the fruit characters.

The experiments are to be continued over a period of years to study the cumulative effects of the various methods.

Authorization of the publication of three volumes dealing with vegetables in the same form as that followed with fruits has been granted by the legislature.

W. F. Morton, assistant in research (chemistry), and Fred P. Nabenhauer, assistant in research (biochemistry), have resigned to accept commercial positions, effective March 1 and April 1, respectively. R. B. Dayton has been appointed assistant in research (chemistry).

Clemson College.—The agricultural building was completely destroyed by fire early in the morning of April 2, causing a loss estimated at from \$200,000 to \$250,000.

Texas College.—A fertilizer school has been opened at Texarkana under the joint supervision of the college and the University of Arkansas. An initial attendance of 300 persons was enrolled from the border counties of the two States.

Virginia Station.—An agricultural survey of the State under the direction of the station was authorized by the 1924 general assembly. According to the text of the act, this survey is for the purpose of gathering information in regard to existing agricultural conditions in Virginia and data upon which to base a study of agricultural economics and a constructive program for the development of agriculture and agricultural resources. The survey "shall include matters pertaining to soils and soil fertility and management; soil erosion and drainage problems affecting soil fertility and productivity; the adaptation of various soil types, elevations, and seasonal conditions to crops produced or which may suitably be produced; farm layout and selection and arrangement of fields for the use of labor-saving machinery and economy and convenience in cultivation and farm operations; methods of cultivation, production and handling of crops, and general farm management; the various crops produced on farms, their yield and gross value compared with the cost of production and courses of low yields; farm labor, its distribution and efficiency; farm incomes of the various classes of farm labor; the relation of various farm products to public needs and local and general supply and demand; farm incomes and sources; capital investment and return; distribution of capital investment; the character and extent of idle lands and their suitability for cultivation or other agricultural purposes in the various localities and what, if any, profitable use may be made of them through the introduction of livestock or crops adapted to such soils, by individuals or on community plan, with notations of elevation, topography, temperatures, and seasonal conditions as affecting fruit production, cotton, or other crops; and any other information or studies which may be advisable in determining methods for the betterment of agricultural conditions and the development of agricultural resources of the State."

Cooperation with appropriate agencies of the Federal Government is specifically authorized.

W. G. Harris, associate chemist, and C. E. Seitz, agricultural engineer, resigned February 1 and March 1, respectively, both to engage in commercial work. J. F. Eheart has been appointed assistant chemist, effective February 7.

Washington College and Station.—In accordance with a request from the governor, who is making a business survey of all State institutions and their needs, the legislature made its appropriations at its recent session for one year only and restricted its grants to necessary salaries and maintenance and a minimum of capital outlay. The college, however, received \$171,690 to complete the dairy manufactures building, \$25,000 to replace the beef cattle barn burned last fall, and \$30,000 for sewer extensions.

Special appropriations of \$18,350 and \$5,334, respectively, were made for the Irrigation Substation at Prosser and the cranberry investigations laboratory in Pacific County, these sums being slightly increased over those granted for the previous year. The regular appropriations for the main station, the Western Washington Station, and the substations at Lind and Waterville were included in the general appropriation for the institution.

Wisconsin University and Station.—A commercial firm in Terre Haute, Ind., has placed at the disposal of the College of Agriculture a fellowship fund of \$2,500 per year for research in connection with the production of butyl alcohol and other products from corn and other starch-containing materials.

The question of whether healthy potatoes may cause mosaic disease in tobacco is being studied. Recent experiments have shown that when the juice from potato foliage, tubers, or roots which are healthy so far as can be determined by the best known available methods, is inoculated into healthy tobacco plants a mosaic disease is produced which can subsequently be transferred indefinitely from one tobacco plant to another.

A new grasshopper formula worked out by the department of economic entomology is reported to have been a distinct factor in the successful grasshopper campaign waged in Door County last summer, from 85 to nearly 100 per cent being killed. Four townships voted funds for the campaign, this being the first time that an attempt has been made on so large a scale to control these pests in the State by cooperative efforts.

The number of inquiries for agricultural publications is constantly increasing, rising from 22,948 requests in 1915 to 43,150 in 1924. During the past year, it is estimated that fully half of the requests received came from teachers and students desiring help in their school work. The material is used not only in agricultural courses but also in many of the science courses given in high schools and other institutions.

What is thought to have been the largest exhibit of country weekly newspapers ever assembled in one contest was shown in connection with the convention of the Wisconsin Press Association, which was held at the college February 5-7. One hundred and thirty-five weeklies representing over 50 Wisconsin counties were entered.

Announcement is made that the annual meeting of the Society of American Bacteriologists will be held at the University in December, 1925.

Wyoming University and Station.—State appropriations were made of \$50,000 for the support of the university in addition to the proceeds of the half-mill tax; \$25,000 for the various substations, together with the authorization of a tenth-mill tax for this purpose, estimated to produce \$40,000 per year but not available until 1926; and \$10,000 for the control of bee diseases and insect pests.

C. B. Clevenger, Ph. D., has been appointed assistant research chemist in the station.

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The study of the soil and soil fertility is a subject which has long attracted the attention of investigators. The awakening of interest in agricultural experimentation in the decade between 1860 and 1870 was perhaps nowhere felt more strongly than in the numerous inquiries into the relation of the soil to plant growth. Following Liebig's generalization of the mineral theory of plant growth, the chemical composition of the soil was extensively studied, and when it was learned that there is no simple relation between the chemical composition of a soil and plant and the fertility of the land the problem was attacked from the physical and biological sides as well. Much of this pioneer work was attempted by the newly established American experiment stations, and at the beginning of the twentieth century no fewer than 36 of these stations were at work on the chemical, geological, and physical relations of soils, or conducting soil tests with fertilizers, or similar enterprises.

In the 25 years which have since elapsed, interest has been well sustained and further developed, and much of the work has been quite productive. That the fundamental importance of investigations on soils and soil fertility is generally recognized by the stations to-day is shown by the number and varied character of the projects devoted to the subject. An examination of the list of such projects for 1924 shows about 550 dealing with soils, soil fertility, and soil fertilization. This is approximately 10 per cent of the total number of projects, and an average of slightly more than 10 projects per station. The group is the fourth largest in the list and covers practically every feature of the subject. The work provided for deals with both general and specialized conditions, and is local, State, regional, and national in scope.

Much of what has been done has admittedly been designed to secure purely empirical results and to answer very simple and practical questions. Such work has rendered a very valuable service, as, for example, in aiding to put the use of fertilizers on a rational basis and in securing a better adaptation of crops and cropping systems to soils, even though it has not gone far, and can not be expected

to do so, in correlating cause and effect and in furnishing scientific explanations of the observed phenomena. It has, however, uncovered a multitude of unsolved problems calling for fundamental investigation.

This condition is quite well understood, and in consequence the station work in this field is now being directed more and more toward fundamental inquiry into the causes of the observed facts and coordinated toward more specific ends. For example, investigation of soil acidity, which is a widespread condition, and of alkalinity, which also affects in the aggregate large areas of land, is being carried beyond mere determination of the intensity of the conditions and practical tests of correctives to the determination of the origin and causes of the observed conditions, the response of plants to them, and the preventive rather than the corrective measures to be adopted. As illustrating this point, a significant trend of recent soil investigation has been in the direction of a somewhat systematic determination of the optimum conditions of soil acidity, or alkalinity, for different kinds of plants and of the simplest and most efficient means of maintaining these conditions permanently.

The type of work which involves the routine accumulation of chemical, crop, and other data, with no more specific object in view than, for example, that of establishing general fertilizer requirements and practices, no longer meets the needs of the situation or measures up to the modern standards of advanced scientific research. On the other hand, no one questions the far-reaching importance of conducting systematic soil surveys and the attendant chemical and field work on fertility, crop adaptations, and management of the different types of soils disclosed by the surveys. These surveys are not only of state-wide but of nation-wide concern and furnish a fundamental basis for soil settlement and management, as well as for experimental and research work. It is, therefore, of the utmost importance that the methods followed should be standardized and systematized and the work pushed to a conclusion on a uniform plan as rapidly as possible.

There is just cause for pride in the comprehensiveness and thoroughness of the survey work of the Bureau of Soils of the U. S. Department of Agriculture. More than 1,220,000 square miles, or over 40 per cent of the total land area of the United States, have now been surveyed, and the surveys are progressing at the rate of about 30,000 square miles a year. Practically all of this work is being done in cooperation with the experiment stations or some other State agency. The stations have taken an active and effective part in the campaign, some in cooperation with the Bureau of Soils, others independently. They have increased the usefulness of the undertak-

ing by supplementing the general survey in various ways, notably with more detailed studies of the various soil types and their fertility needs and crop adaptations. Such investigation is developing strongly in the direction of specific studies of the various soil factors influencing production. It is dealing with the soil in action rather than merely as a storehouse of fertility, as dynamic rather than static.

The different phases of the question of soil reaction and its adjustment and maintenance to meet the requirements of crop production are receiving much attention at the stations. This work is of obvious importance and promise. It has been suggested that determinations of acidity and basicity should be included in all systematic studies of soils and plant distribution, especially since convenient and fairly accurate methods for this purpose have now been devised.

The work in progress on soil acidity is widely distributed throughout the country, including 18 States and 20 projects. It involves not only studies of the general nature, properties, and intensity of the acidity in different soils, but also more specific and fundamental studies of the relation between active acidity and hydrogen-ion concentration, the optimum hydrogen-ion concentration limits for individual crops, and the nature and control of buffer action in soils with reference to its influence on the adjustment of reaction.

The correction of soil acidity by liming and the determination of the so-called lime requirements of soils have formed the basis of considerable work. There are 41 active projects at 18 of the stations on different phases of the liming question, including comparisons of different forms of lime, rate of liming, and different degrees of fineness, usually with reference to the requirements of individual soils or crops.

Excessive alkalinity in soils is also an important and pressing problem in many localities. Practically all of the stations throughout the irrigated and semiarid portions of the country are engaged in studies relating to the nature, amount, cause, and manner of occurrence of alkalies in different soils, of the tolerance of important individual crops for different alkalies and alkali combinations, and of methods of overcoming the injurious effect of excess alkalinity in soils.

It would seem that treatments of excesses of soil acidity and of soil alkalinity, while of opposite character, are closely related in that the practical correction of either amounts to an adjustment of soil reaction to meet the requirements of crop production. Various treatments besides liming are known to influence soil reaction, and there is reason to believe that there are certain practical limits of hydrogen-ion concentration for each of the important individual crops.

Cooperative projects by groups of stations interested in soil reaction would seem justified, their objective to be the determination of optimum hydrogen-ion limits for important individual crops in the entire practical range of cultivated soils and under the climatic conditions imposed by different localities. A second series of cooperative projects might attempt to produce and maintain these optimum hydrogen-ion concentration limits for each crop under various conditions. An important fundamental feature of this work would be to determine the nature and intensity of and how to control the buffer action of different soils, and this would involve a study of the entire practical range of cultural and fertility treatments of soils which may influence their reaction. The preliminary work along these lines is already in progress at several of the stations.

A complicating factor in the adjustment of soil reaction is the accompanying or resultant effect on the physical properties of certain soils. This is especially important where excessive alkalinity is removed by leaching, resulting in deflocculation and impermeability of the soil. In such cases the influence of colloids comes especially into play. Station work specifically devoted to soil colloids and their relation to soil properties and productiveness is somewhat limited, but attempts at the practical application of the principles involved are quite general. At least 11 stations are interested in one phase or another of the maintenance of the proper kind and amount of organic matter in soils, involving more or less the question of colloids. There are 12 active projects relating exclusively to soil physics, prominent among and typical of which are investigations on the character of the colloids of clay soils and the colloidal swelling of dry soil when wetted. In addition there are 27 projects in operation on some phase or other of tillage, the majority of which are comparative investigations of tillage methods under both humid and semiarid conditions in which colloids necessarily play an important part.

The Bureau of Soils has undertaken an exhaustive study of the nature, properties, and functions of soil colloids, with special reference to their governing influence on the physical and chemical properties of soil. Some of the stations are studying the question from the viewpoint of the relation of physical properties to such practical operations as tillage. While many of the tillage projects do not make it quite plain exactly what it is desired to accomplish by tillage, some of the stations are attempting to arrive at standards of so-called optimum degrees of soil tilth for individual crops, and at least one is analyzing the process of producing such degrees of tilth in terms of the controlling physical properties of the soil and is interested in a study of soil colloids as the factor most strongly

influencing those physical properties. It is along such lines that it may be hoped to raise such experiments to the level of scientific research.

The work of several of the stations indicates that the exchange and absorption of bases and fertility constituents in soils are also based largely on colloidal phenomena, and the reclamation of alkali soils by leaching involves a difficult problem in some cases due to the deflocculation of colloidal material when the flocculating bases are removed. It would seem that a concerted study of colloids for the purpose of establishing their nature and properties with reference to their specific influence on the physical and chemical factors in different soils, in relation to the maintenance of optimum degrees of tilth, conditions of fertility, and reaction for important individual crops, might well be attempted.

The need of additional knowledge relating to nitrogen accumulation in and loss from soils under different systems of cropping and management and its influence on soil fertility is indicated by the facts that nitrogen is one of the most important plant nutrients, one of the most expensive to apply to the soil in artificial forms, and one of the most difficult to maintain in available forms and in suitable amounts in soils. There are now about 31 active projects at 16 different stations on the soil nitrogen question which are strikingly similar in character, in that they deal as a rule with the factors governing nitrification, nitrate accumulation, nitrogen fixation, and the maintenance of the nitrogen content of soils. In addition there are about 30 other projects at 19 stations, the majority of which deal with the influence of various fertility and cultural treatments and environmental conditions on the bacterial activities in soils, more particularly those of ammonification, nitrification, nitrogen fixation, and denitrification. There are also projects on stable and green manuring and on comparative tests of nitrogenous fertilizers, the majority of which have a bearing on the nitrogen supply of soils.

The making of routine ammonification, nitrification, and nitrogen fixation determinations under different conditions has not yielded data capable of explaining the nature and control of these important processes. It seems evident that more should be done to elucidate the conditions affecting the physiology of the processes of nitrification, nitrogen fixation, denitrification, and the like in the soil. The results of such work should serve as a basis for studies as to how best to supply the nitrogen requirements of individual crops in different soils.

There is a relatively large number of projects the purpose of which is to compare different carriers of phosphoric acid, potash,

sulfur, and other constituents, although work of a fundamental nature on the factors governing the supply and availability to plants of the inorganic nutrients is limited. A distinct tendency is evident to restudy the fundamentals of plant nutrition, and many promising investigations in this line are in progress. The question of the behavior in the soil and the physiological effect not only of the better known inorganic plant nutrients but also of the rarer or less well known constituents of soils needs to be more thoroughly studied than has yet been done, although recent years have witnessed some notable advances in this field.

Cooperative studies of the specific requirements of important individual crops for phosphorus, the ability of different soil phosphorus compounds to meet such requirements, methods of treatment of different soils for the production of soil phosphorus compounds of optimum availability, and the question of phosphorus deficiency in soils and crops with special reference to animal nutrition might well be undertaken. Already the work at some of the stations is turning in that direction. In addition, experiments such as those being conducted by the Bureau of Soils on the production of concentrated available phosphates may well serve to indicate lines along which studies of phosphatic fertilizers at the stations may be changed from general to more specific and ultimately more productive research.

Only a somewhat limited interest is being manifested by the stations in the fundamental features of the potash question, the work, beyond comparative tests of commercial potassic fertilizers, being confined largely to studies of the factors governing the availability of soil potash compounds to crops and to lysimeter studies of the movement of potash in soils. It seems probable that this relatively restricted inquiry is due to the fact that many soils are well supplied with potash in one form or another. In view of the relatively recent agitation of the potash fertilizer question, however, it would seem advisable to undertake some cooperative work to determine the specific requirements of important individual crops for potash and the ability of soil potash compounds to meet these requirements, as well as to develop methods of treatment of different soils to maintain an optimum availability of the potash.

Aside from considerations of their relation to soil reaction, there is apparently little in progress at the stations on the subject of calcium and magnesium other than studies of their movement in the soil. Owing to the important bearing of these substances on the physical, chemical, and biological properties and productiveness of soils, it would seem that a further study of the nature of their occurrence and activities in soils might well be initiated.

Considerable attention is being given to the question of sulfur as a soil constituent and plant nutrient. In certain apparently re-

stricted areas and with certain crops it appears that sulfur may become the limiting element of fertility. The work so far, beyond comparative tests of different sulfur compounds as fertilizers, seems to be confined to studies of the specific needs of certain soils and crops for sulfur, the availability of the soil sulfur compounds, and the movement of the sulfur under different conditions of climate, cropping, culture, and fertilizing practices. Some interesting work has been undertaken on the relation of sulfur to soil reaction and to the decomposition of manure. These studies indicate the possibility that sulfur deficiency may be widespread and would seem to justify further inquiry into the subject.

Soil moisture, a factor of primary importance in crop production, is the subject of at least 21 projects at a dozen or more of the experiment stations, in some cases in cooperation with the Department of Agriculture. It naturally receives special attention from stations in the regions where irrigation or dry farming is necessary. In such cases the work is devoted mainly to studies of the specific water requirements of individual crops and the movement, distribution, and conservation of soil moisture in different soils and the factors affecting them, such as tillage, cropping, and manurial treatments. Other studies deal with forms of soil moisture and its retention and movement in different soil types, with special reference to its availability to crops and its influence on the physical properties of soils. The essential problems are to maintain optimum moisture conditions in the soil, to adapt plants to the prevailing conditions of climate (precipitation) and soil, and so to modify the conditions by tillage, fertilizers, and other means as to enable the plant to make the best possible use of the available moisture. As individual pieces of research some of these projects do not seem to be approaching any very definite goal. Taken collectively, however, there is evidence that distinct advance is being made toward elucidating the functions of moisture in soils and determining the factors which control them, and some outstanding work in this direction is in progress.

A pressing feature of the soil moisture problem at present is the demand for exact determinations of the duty of water for different crops and soil types. While emphasis is being placed upon this feature in some of the work in progress, its further development and extension seems desirable. Much can be done by cooperative efforts by interested stations in the study of the features of this problem of common significance.

Taken as a whole, the work on soils and soil fertility at the stations may be said to fall into three broad groups, (1) high grade

research projects having very definite and ultimately practical objectives, (2) fundamental projects having highly specialized and technical objectives, and (3) very general projects involving comparative testing or the making of routine determinations, which have no very specific object in view, or have largely served their purpose and might be continued indefinitely without yielding any new or broadly applicable results. The question naturally arises whether many of the last class might not be profitably replaced by projects of a higher and more productive order. Obviously they should have only a very limited place in the station program. Many of the projects of the second type, when considered collectively, fit logically into possible programs of cooperative investigation having very clearly defined practical objectives. It is encouraging to note that there is a growing tendency at the stations to recognize the importance of increasing the number of projects of the first type.

Perhaps the outstanding conclusion from this study is that stations interested in the accomplishment of a common purpose might with advantage get together, plan a program of procedure, and apportion the work where it can best be prosecuted. Such a course would, it is believed, prevent duplication of effort, make for standardization of methods, and hasten results. There are many indications that such a procedure is likely to find increasing favor in the new era of investigation which the passage of the Purnell Act seems to have begun.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

The "Chemical Age" chemical dictionary.—Chemical terms (*London: Ernest Benn, Ltd., 1924, pp. 158*).—This is a compilation of definitions of terms employed in organic, inorganic, physical, analytical, and biochemistry, including names of general classes of compounds and the radicals of which they are composed, types of reactions, theories and laws, special tests and reactions, etc. Numerous cross-references and illustrations add to the usefulness of the volume.

The chemistry of plant products, G. TRIER (*Chemie der Pflanzenstoffe. Berlin: Borntraeger Bros., 1924, pp. VIII+605, fig. 1*).—The first 50 pages of this monograph consist of a historical survey of plant chemistry, with a brief general discussion of the chemistry of plant products. In the main text, plant products are classified and discussed under three general groups—simple compounds, complex compounds, and compounds of unknown nature. The first and largest of these groups includes aliphatic and cyclic compounds of known composition, and a third subgroup of substances whose composition is not entirely known, such as resins, humins, and certain color pigments. The second group includes glucosidic compounds, complex esters, and conjugated proteins, and the third toxins and antigens, vitamins, and enzymes.

The chemistry of enzyme actions, K. G. FALK (*New York: Chem. Catalog Co., Inc., 1924, 2. ed., rev., pp. 249, figs. 33*).—A revision of the volume previously noted (*E. S. R., 45, p. 108*).

Complex salts, W. THOMAS (*London: Blackie & Son, Ltd., 1924, pp. XI+122, figs. 11*).—This volume, which is one of the series entitled *Manuals of Pure and Applied Chemistry*, edited by R. M. Caven, deals with modern theories concerning the chemical constitution of complex salts, methods for their preparation and separation, and applications to qualitative and quantitative analysis.

The alteration of the H-ion concentration in bacterial cultures and the mechanism of the change [trans. title], S. SIERAKOWSKI (*Biochem. Ztschr., 151 (1924), No. 1-2, pp. 15-26, figs. 2*).—To determine the changes in H-ion concentration in culture media resulting from the growth of the inoculated bacteria, samples of a meat extract bouillon prepared with 1 per cent peptone and 0.5 per cent NaCl were adjusted to varying pH values by the addition of hydrochloric acid and sodium hydroxide, inoculated with bacteria, and incubated for 14 days, with daily determinations of the H-ion concentration by the colorimetric method.

The changes in pH value were found to take place in two stages. During the first 3 days the reaction of all tended to approach neutrality. This period is called the regulation phase, and is followed by a second in which the H-ion concentration of all the media tended to approach an alkaline value of from pH 8.7 to 9.3.

The changes in H-ion concentration appeared to be related to the growth of the bacteria. The bacteria grew most rapidly in media whose H-ion concentration was nearest the point reached at the end of the regulation phase. The more the original H-ion concentration varied from this, either on the side of acidity or alkalinity, the slower was the growth of the bacteria and the later the period of maximum growth. If no bacterial growth took place, there was no alteration in the pH value of the medium.

The mechanism of the adjustment of H-ion concentration is considered to be largely through the production of carbon dioxide. In alkaline media the carbon dioxide produced is partly dissolved in the medium and partly used in the formation of carbonates or bicarbonates which tend to acidify the medium. In acid media carbon dioxide is also formed, but the formation of carbonates and bicarbonates is impossible and the portion of carbon dioxide which is not dissolved escapes.

Chemical factors influencing quality of wheat and flour (*Kansas Sta. Bien. Rpt. 1923-24, pp. 51, 52*).—This progress report has been essentially noted in a paper by Working (*E. S. R., 52, p. 202*).

Studies on the oil and ammonia content of cottonseed.—**Progress report on basic research problem I**, A. F. SIEVERS (*Jour. Oil and Fat Indus., 1 (1924), No. 2, pp. 56-61*).—A general report is given of the analysis, with particular reference to oil and ammonia, of samples of cottonseed from 29 varieties grown at 10 different experiment stations in localities of considerable rainfall, limited rainfall, and under irrigation.

For uniformity of results the oil determinations were made on the seed delinted with sulfuric acid, dried, and extracted with petroleum ether. It was found that the 29 varieties could be placed in three groups, including 9 with high, 11 with medium, and 9 with low oil content. The average content of oil in the seeds of the low oil group was 22.43 and of the high oil group 24.31 per cent. The highest oil content of any of the samples was 31.74 per cent and the lowest 15.29 per cent. The variety giving the largest amount yielded only 16.01 per cent at another station, while the one giving the smallest amount yielded 28.68 per cent at another station. In general, however, the high- and low-yielding varieties fell into the same groups at the different stations. The seeds in the high oil group contained 3 per cent more kernel than those in the low oil group. In all cases where the different varieties at the same station all produced plump and fully matured seed, the kernels of the seed in the high oil group had a distinctly higher oil content than those in the low oil group. The average weight of the seed was only slightly higher for the low oil than for the high oil group.

The ammonia determinations were made on the whole seed, and the percentages calculated on this basis as well as on the delinted seed basis. The percentages of ammonia did not show any marked varietal relationship, but in the same variety seed which in some localities had a high and in others a low oil content tended to have low and high contents of ammonia, respectively.

It is emphasized in conclusion that climatic conditions are of great importance in regard to the yield of oil from cotton seed. The seed yielding the best oil was from one of the irrigated stations not depending upon natural rainfall. "Perhaps the most interesting fact, however, is that under all the diverse conditions obtaining at the stations represented the relative rank of the varieties as regards yield of oil has, with few exceptions, been the same at all the stations. Certainly this should be sufficient basis to justify a con-

tinuation of this work over a sufficient number of years to eliminate, as far as possible, those factors which change from year to year and which are not generally subject to control."

The sulfuric index of cottonseed oil and in admixtures with olive oil, J. K. MORTON and G. C. SPENCER (*Jour. Oil and Fat Indus.*, 1 (1924), No. 2, pp. 66-71, fig. 1).—A study is reported from the Bureau of Chemistry, U. S. D. A., of the value of the sulfuric index of Mazzaroni (E. S. R., 36, p. 205) as a means of the identification of simple oils or of the constituent oils in mixtures. The test depends upon the reaction of the oil with sulfuric acid, with the formation of a gas, chiefly SO_2 , which is let into a standard iodine solution and determined by titration of the excess iodine with standard sodium thiosulfate. The number of cubic centimeters of N/10 iodine consumed is the sulfuric index of the oil.

The apparatus for the determination is described and illustrated, and the technique of the process is given in detail. Data are reported on the maximum, minimum, and average values obtained in several determinations with a number of samples of refined cottonseed oil from different localities, with mixtures of cottonseed oil and olive oil, and with various other oils. The minimum and maximum values reported for genuine cottonseed oil were 56.1 for a sample of cooking oil from North Carolina and 92.7 for Tennessee prime summer yellow cottonseed oil. Indices reported for other oils were California olive oil 2.1, 2.54, 2.6, and 2.2, Italian oil 1 and 1.21, tea seed oil 1.62, coconut oil 0.8, sesame oil 52.67 and 51.97, apricot oil 15.1 and 14.3, cold pressed peanut oil 5.73, and sunflower seed oil 138.1.

In mixtures of olive and cottonseed oil the sulfuric index was not proportional to the quantity of either oil present. Olive oil with additions of cottonseed up to 25 per cent showed only a slight increase in the sulfuric index, while cottonseed oil with 10 per cent of olive oil showed a marked decrease in the index. It is concluded that as a routine method it does not compare with the iodine number, but that it does compare favorably with this as a means of identification of an unadulterated oil. It is emphasized that the conditions of the determination must be carefully controlled if the results are to be of value.

Methods of determining lactose [trans. title], B. BLEYER and H. STEINHAUSER (*Milch. Forsch.*, 1 (1924), No. 3-4, pp. 131-199, fig. 1).—This is a report of an extensive investigation of methods given in the German literature for the determination of lactose.

A method for the estimation of iron in small quantities in biological substances, M. M. MURRAY (*Biochem. Jour.*, 18 (1924), No. 5, pp. 852-854).—This is the usual potassium permanganate method modified by the use of a reductor instead of the usual Bunsen valve previous to the titration with permanganate and by titration in an atmosphere of hydrogen. The reductor for the conversion of the iron to the ferrous condition consists of a tube 75 by 2.5 cm., packed for a distance of 30 cm. with zinc which has been soaked in 2 per cent cadmium sulfate solution for 5 minutes and then washed. The reductor and the burette for the standard permanganate solution are inserted in a 2-holed rubber stopper in a glass filter flask. This is connected to a pump, and the solution containing the iron in 10 per cent sulfuric acid is poured into the reductor and allowed to pass into the flask at a slightly slower rate. The standard permanganate solution is run into the flask from the burette with the pump still in operation.

A simple clinical method for the determination of small amounts of potassium in blood serum and other fluids [trans. title], F. LEBERMANN (*Biochem. Ztschr.*, 150 (1924), No. 5-6, pp. 548-559).—The method described

consists essentially in precipitating the potassium as potassium cobaltic nitrite in centrifuge tubes, centrifuging, dissolving the washed and dried precipitate in 27 per cent HCl, and determining the blue-green color by comparison with suitable standards in a Duboscq colorimeter or by means of a color scale. With the use of suitable micro apparatus, the method is said to be applicable to the determination of potassium in 0.1 cc. of blood serum. It is said to compare favorably in accuracy with the Kramer-Tisdall method (E. S. R., 45, p. 507), and to be much more simple and rapid of execution.

Note on the estimation of uric acid by the Hopkins-Folin method, R. C. GARRY (*Biochem. Jour.*, 18 (1924), No. 5, pp. 913-918).—Conditions essential for accuracy in the determination of uric acid in urine by the Hopkins-Folin method of precipitation as ammonium ureate are outlined.

Blank determinations on water, sulfuric acid, and filter paper similar to that used in collecting the precipitate are considered necessary. A time limit of 10 seconds, a uniform temperature of 60° C., and uniform amounts of ammonium sulfate (not more than 100 cc.) and of other reagents are recommended. The degree of dilution of the uric acid and the presence of traces of chlorides are considered not to interfere with the test.

A colorimetric method for the direct estimation of ammonia in urine, A. P. ORR (*Biochem. Jour.*, 18 (1924), No. 5, pp. 806-808).—The method described depends upon the observation that amines or imines in the presence of sodium hypochlorite react with phenols to form *p*-nitrosophenol, which in excess of phenol gives *p*-benzoquinonoxypyphenylimine, which has a blue color in solution. As applied to urine, the test must be conducted in the cold to prevent action between urea and the alkaline hypochlorite. The technique of the test is as follows:

To 4.5 gm. of pure phenol crystals in a 50-cc. beaker is added 5 cc. of a well-mixed dilution of 20 cc. of urine in 100 cc. of water. After the phenol crystals are completely moistened, 20 cc. of sodium hypochlorite solution prepared by diluting the commercial solution with an equal volume of distilled water is added and the beaker shaken gently. The color is allowed to develop for 5 minutes, and the contents of the beaker is then washed out with distilled water into a 250-cc. measuring flask containing about 100 cc. of distilled water. The solution is diluted to the mark and mixed, and the color compared in a Duboscq colorimeter with a standard prepared by treating 5 cc. of the standard ammonium sulfate solution in a similar manner.

The effect of cold and hot liming on the removal of albumin from cane juices, R. G. W. FARNELL (*Internatl. Sugar Jour.*, 26 (1924), No. 307, pp. 359-363).—A comparison on a laboratory scale of the effectiveness of hot v. cold liming in removing the nitrogenous substances from raw cane sugar is reported on five different samples of juice. The data reported include the pH values and concentration in Brix of the raw and clarified sugars and the amount of nitrogen removed by cold and hot liming.

In all but one case a much larger amount of nitrogen was removed by the hot than the cold process, and in all cases the pH values of the hot limed juice were higher than of the cold. The optimum pH value for liming the hot juice is considered to be about pH 8.

The chemical composition of Palestine olives and their oil, F. MENCHIKOWSKY (*Zionist Organ. Inst. Agr. [etc.] Agr. Expt. Sta. Bul.* 2 (1924), pp. 3-17, figs. 13).—Descriptions and analyses are given of several varieties of olives grown in different sections of Palestine and of the corresponding oils.

The olives varied in size from very small, weighing between 1.7 and 2.2 gm. each, to large, weighing from 3 to 7 gm. each. The differences in weight were

largely in the flesh, the weight of the seeds with one exception varying only from 0.4 to 0.71 gm. The minimum, maximum, and average values obtained in the analysis of the flesh of the olives are as follows: Moisture 19.1, 55.55, and 37.51; fat 23.82, 51.14, and 38.19; protein 1.37, 2.72, and 1.8; and ash 1.02, 2.35, and 1.92 per cent, respectively. As compared with Mediterranean olives, the data indicate that the Palestinian olives are low in fat, salts, and protein. This is thought to be due to the poor soil upon which they are grown.

The oil obtained by pressing the flesh of the olives through linen bags and filtering through cotton gave the following minimum and maximum constants: Specific gravity $15^{\circ}\text{C}/4^{\circ}\text{C}$. 0.916 and 0.918, saponification number 187.5 and 191.9, Reichert-Meissl number 0.46 and 1.84, iodine number 81.75 and 88.41, iodine number of liquid acid 93.42 and 106.6, percentage of liquid acid 86.58 and 94.23, and percentage of solid acid 5.77 and 13.42. These values are thought to compare favorably with olive oil from other sources.

The preparation and refining of olive oil in southern Europe, W. V. CRUESS (*California Sta. Circ.* 279 (1924), pp. 43, figs. 24).—This supplements Circular 278 of this station (E. S. R., 52, p. 207) by a similar description of the preparation and refining of olive oil in Spain, France, and Italy, with a preliminary discussion of the general status of the olive-oil industry in these countries. The processes throughout are compared with those in use in California, with suggestions as to the adoption of some of the methods described.

Vinegar, C. J. SCHOLLENBERGER (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7-8, pp. 128-130).—Brief directions are given for making cider vinegar in the home.

The industry of perfumes according to the theories of modern chemistry, M. P. OTTO (*L'Industrie des Parfums d'après les Théories de la Chimie Moderne. Paris: Dunod, 1924, 2. ed., rev. and enl., pp. XLIII+688, pls. 9, figs. 98*).—In part 1 of this reference book on perfumes the chemistry of perfumes is discussed, with a classification according to chemical structure and methods for analysis and for the detection of adulterants. Part 2 deals with natural and part 3 with artificial perfumes, classified according to the chemical nature of their principal constituents. In the section on natural perfumes maps are included showing the geographical distribution of the sources of the more important perfumes.

METEOROLOGY

Records of total solar radiation intensity and their relation to daylight intensity, H. H. KIMBALL (*U. S. Mo. Weather Rev.*, 52 (1924), No. 10, pp. 473-479, figs. 5).—In this paper, which represents work done in cooperation with the Illuminating Engineering Society of America, "an attempt is made to ascertain with what degree of accuracy records of the total radiation, or heat energy, received on a horizontal surface directly from the sun and diffusely from the sky, may be used to determine the intensity of daylight illumination on a horizontal surface. . . . From Abbot's normal solar energy curve and atmospheric transmission coefficients for different wave lengths of light, also due to Abbot, the ordinates have been computed for solar energy curves in atmospheres of different degrees of transparency and with the sun at different zenith distances. The ordinates of energy curves for a Planckian distribution at temperatures corresponding to color temperatures of skylight measured by Priest and others have also been computed and combined with the ordinates of the solar energy curve to determine the energy distribution in the total radiation received on a horizontal surface.

"The results indicate that midday radiation is richer in luminous rays than the radiation that is received when the sun is near the horizon. Comparisons between photometric measurements of daylight and pyr heliometric measurements of the total radiation lead to the same result. They indicate, however, that if the radiation intensity on a horizontal surface, expressed in gram calories per minute per centimeter, is multiplied by 6,700 the result will give the illumination intensity on a horizontal surface in foot-candles within ± 5 per cent, giving values which near noon are too low and which are too high when the sun is near the horizon. . . . With the sky covered with clouds the factor averages higher, probably not far from 7,000."

A systematically varying period with an average length of 28 months in weather and solar phenomena, H. W. CLOUGH (*U. S. Mo. Weather Rev.*, 52 (1924), No. 9, pp. 421-441, figs. 6).—In this paper various statistical data and methods are employed, which "indicate a systematic and persistent tendency to a recurrence of similar phases which differs from that due to chance alone. . . .

"The variations of rainfall show the short cycle with less regularity than those of pressure and temperature, in conformity with the more nearly fortuitous character of this element. . . . It is found that the period under discussion has a mean length of about 28 months, subject to systematic variations in length attributed to the 11-year sun-spot period, the 35-year Brückner variation, and to a long secular change, perhaps indicative of a 300-year cycle. . . . A new graphical scheme is described which facilitates the accurate evaluation of the mean length of the period at any time."

Discussing the paper, C. F. MARVIN states that the author "supports his findings by a substantial array of proofs," but points out that "we must recognize that in its present form we are undoubtedly dealing with a very complex feature of periodicity, probably made up of two or several elemental forms. . . . A large number of elemental periods always appear to be necessary to even approximately represent the observations. . . . The subject has by no means been adequately investigated, and is entitled to the serious attention of students and critics alike."

Let us simplify our calendar and publish statistical data in standardized summaries, C. F. MARVIN (*U. S. Dept. Agr., Weather Bur.*, 1924, pp. 7, fig. 1).—The stated object of this paper, presented at the meeting of the International Geodetic and Geophysical Union, Madrid, Spain, in October, 1924, is "to enlist the sympathetic attitude of mind of scientists of the world toward simple changes of our calendar in order to provide for the easy publication of the data of meteorology, economics, agriculture, business, etc., in simple standard time and geographic units." A 13 equal months calendar is suggested and explained.

Monthly Weather Review, [September-October, 1924] (*U. S. Mo. Weather Rev.*, 52 (1924), Nos. 9, pp. 421-472, pls. 12, figs. 9; 10, pp. 473-520, pls. 13, figs. 15).—In addition to detailed summaries of meteorological and climatological data and weather conditions for September and October, 1924, and notes, abstracts, and reviews, these numbers contain the following contributions:

No. 9.—A Systematically Varying Period with an Average Length of 28 Months in Weather and Solar Phenomena (illus.), by H. W. Clough (see above); Van Bemmelen on the Intratropical Part of the General Circulation of the Atmosphere (illus.), by B. M. Varney; Mitchell on West Indian Hurricanes and Other Tropical Cyclones of the North Atlantic Ocean.—A review,

by A. J. Henry (see p. 416); Tornadoes in Wisconsin, September 21, 1924, by W. P. Stewart; Rainfall and Drainage Operations, by E. V. Willard; and The Climagram, by G. Hellmann, trans. by B. M. Varney.

No. 10.—Records of Total Solar Radiation Intensity and Their Relation to Daylight Intensity (illus.), by H. H. Kimball (see p. 413); Application of Schuster's Periodogram to Long Rainfall Records, Beginning 1748 (illus.), by D. Alter; The Vapor Pressure of Ice and of Water below the Freezing Point (illus.), by E. W. Washburn; Temperature Lag of the Oceans, by W. J. Humphreys; Graphical Method of Compounding Vectors (illus.), by W. C. Haines; Why an Oak Is Often Struck by Lightning; a Method of Protecting Trees against Lighting, by R. N. Covert; Some Features of the Climate of Alaska, by M. B. Summers (E. S. R., 51, p. 718); On the Application of the Frontal Theory to Cyclones in the Sahara, by M. L. Petitjean, trans. by B. M. Varney; Secondary Depressions in the Adriatic Sea, by F. Eredia, trans. by B. M. Varney; and Notes on the West Indian Hurricane of October 14-23, 1924, by C. L. Mitchell.

Climatological data for the United States by sections, [September-October, 1924] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 11 (1924), Nos. 9, pp. [190], pls. 4, figs. 2; 10, pp. [188], pls. 4, figs. 2*).—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for September and October, 1924.

Meteorological summaries for the year 1923 (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 57-59*).—Tables compiled from the records of the U. S. Weather Bureau Station at Lexington, Ky., summarize data for temperature, precipitation, humidity, wind, and cloudiness, 1872-1923.

Meteorological observations [at the University of Maine, Orono], J. S. STEVENS (*Maine Sta. Bul. 315 (1923), pp. 112, 113*).—A summary is given of monthly and annual temperature, precipitation, cloudiness, and wind during 1923. The mean temperature for the year was 34.5° F., as compared with 42.81° for 55 years. The precipitation was 35.12 in., as compared with the 55-year mean of 39.31 in. The snowfall was 117 in., the number of clear days 121.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and J. BOWER, JR. (*Massachusetts Sta. Met. Buls. 431-432 (1924), pp. 4 each*).—Summaries are given of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during November and December, 1924. The data for November are briefly discussed in general notes. The December number gives a summary for the year, the principal data of which are as follows:

Mean pressure 30.01 in.; mean (hourly) temperature 46.6° F., maximum 97° August 7, minimum -8° January 27 and 28; total precipitation 30.96 in., snowfall 45 in.; cloudiness 1,637 hours; bright sunshine 2,838 hours (63 per cent); prevailing direction of wind, west; total movement 53,855 miles, maximum daily 553 miles March 12; last frost in spring May 2, first in fall September 24; last snow April 8, first November 9.

Meteorological report for the year 1923, E. BURKE (*Montana Sta. Rpt. 1923, pp. 61-63*).—Observations at Bozeman, Mont., on temperature, precipitation, cloudiness, humidity, evaporation, and wind are briefly summarized.

The temperature for the year, 42.1° F., was slightly above normal. The precipitation, 14.9 in., was considerably below normal, the deficiency being largely during the fall and winter. "The extra amount of precipitation that fell during the months of May and June, coupled with that which fell during July, brought about a condition quite favorable for plant growth. . . . The

rate of evaporation was not so great as usual. This was also a factor in giving the precipitation a greater value in promoting crop growth." The last killing frost in spring occurred May 14, the first in autumn, October 8. The number of clear days was 152.

West Indian hurricanes and other tropical cyclones of the North Atlantic Ocean, C. L. MITCHELL (*U. S. Mo. Weather Rev. Sup. 24* (1924), pp. III+47, pls. 11, figs. 93; rev. in *U. S. Mo. Weather Rev.*, 52 (1924), No. 9, pp. 446, 447).—This reports a general study of the tropical storms of the North Atlantic Ocean in connection with which all previously published storm tracks from 1887 to date were replotted. "In every instance the first evidence of storm development, although rather obscure in some cases, was found either over the western third of the Caribbean Sea (west of longitude 78° W.) or to the east of the eastern limits of the Caribbean Sea," thus confirming the author's previous conviction "that West Indian hurricanes never originate over the eastern two-thirds, approximately, of the Caribbean Sea." The review is by A. J. Henry.

The weather and maple sugar production, P. A. HERBERT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 60-62, fig. 1).—A correlation of varying sugar production with temperature, precipitation, and sunlight from 1915 to 1924 indicates that precipitation is the most important individual climatic factor affecting sugar production, and that the greater the precipitation during the growing season and immediately preceding the sugar season the greater the amount of sugar produced. Apparently, "there is always sufficient heat and sunlight present during the growing season to produce the maximum amount of sugar."

SOILS—FERTILIZERS

Soil survey of Page County, Iowa, A. M. O'NEAL, JR., and R. E. DEVEREUX (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1921, pp. III+349-373, fig. 1, map 1).—This survey, made in cooperation with the Iowa Experiment Station, deals with the soils of an area of 339,840 acres in southwestern Iowa. The topography varies from flat or gently sloping to rolling or strongly rolling. The drainage of the county is carried by the East Nishnabotna, Nodaway, and East Nodaway Rivers and their tributaries. Since the rivers and larger creeks have been ditched and straightened, only during periods of excessive floods are even the lower parts of the bottoms overflowed.

The soils of the county are grouped as those developed under conditions of poor drainage and those developed where the more active movement of the drainage waters has given rise to better aeration and oxidation. Including riverwash, 9 soil types of 6 series are mapped, of which the Marshall, Wabash, and Shelby silt loams cover 60.5, 16.9, and 16.8 per cent of the area, respectively.

Soil survey of Garrard County, Kentucky, J. A. KERR and S. D. AVERITT (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1921, pp. III+509-550, pls. 2, fig. 1, map 1).—This survey, made in cooperation with the Kentucky Experiment Station, deals with the soils of an area of 151,680 acres lying mainly in the blue grass region in east-central Kentucky. The northwestern part of the county includes considerable areas of undulating and gently rolling country. The north-central part is mainly hilly and deeply dissected, and the south-central part is mainly rolling to hilly. The southern part is a district of high rugged land.

The soils of the county are of sedimentary, residual, and alluvial origin. Including rough stony land, 14 soil types of 11 series are mapped, of which

the Lowell silt loam and Culleoka gravelly silt loam cover 28.3 and 16.8 per cent of the area, respectively. Chemical analyses of the various soil types are included.

Soil survey of Cherokee County, North Carolina, R. C. JURNAY ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+305-322, fig. 1, map 1*).—This survey, made in cooperation with the North Carolina Department of Agriculture and Experiment Station, deals with the soils of an area of 295,680 acres lying wholly in the Appalachian Mountain province in the extreme southwestern corner of North Carolina. The prominent surface features are sharp, narrow mountain ridges and peaks and narrow valleys. The county is said to be naturally well drained.

The soils are of residual and alluvial origin. Including rough stony land and rock outcrop, 13 soil types of 8 series are mapped, of which Porters stony loam, Talladega silt loam, Porters loam, rough stony land, and Talladega slate loam cover 23.4, 22.7, 13.9, 12.6, and 11.7 per cent of the area, respectively.

Soil survey of McCook County, South Dakota, W. I. WATKINS ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+451-471, fig. 1, map 1*).—This survey, made in cooperation with the South Dakota Experiment Station, deals with the soils of an area of 366,720 acres in southeastern South Dakota. The topography is comparatively flat. The internal drainage of the soils is good, except for some small areas and one large area in the northwestern part of the county. Small areas in which the surface drainage is poor, resulting in the formation of intermittent lakes, are scattered over the county. Dissection by streams has not reached a stage that provides drainage to all farms.

The soils of the county are of glacial, lacustrine, and alluvial origin, by far the greater part being glacial. Eleven soil types of 6 series are mapped, of which the Barnes silt loam and loam cover 52.8 and 28.4 per cent of the area, respectively.

Soil survey of Union County, South Dakota, J. A. KERR ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+473-508, fig. 1, map 1*).—This survey, made in cooperation with the South Dakota Experiment Station, deals with the soils of an area of 289,280 acres in extreme southeastern South Dakota. The uplands, which occupy the central and northern parts of the county, lie in two main divisions. The eastern and larger division is a high loessial plain, gently rolling in the northern and hilly in the southern and eastern parts. The western uplands are a part of a wide morainal plain, in which drainage ways have not been generally established. The northern part of this plain is high and broadly undulating and is adequately drained. The southern part is lower and more nearly flat with imperfect drainage in the interior. The southern third of the county lies in the Missouri River bottoms.

The upland soils of the county are developed from transported material consisting of both glacial till and loess. Including riverwash and dunesand, 26 soil types of 12 series are mapped, of which the Marshall, Lamoure, and Barnes silt loams cover 35, 11.5, and 10.6 per cent of the area, respectively.

A study of several organic soil profiles, M. M. McCool and A. G. WEIDEMANN (*Soil Sci., 18 (1924), No. 2, pp. 117-129, figs. 3*).—Studies conducted at the Michigan Experiment Station are reported which showed that the amount of water an organic soil contains has some influence on the amount it will hold unfree, the latter being greatest where the water content is high. Air-drying a soil and wetting it again were found to have no effect on the amount of water it will hold unfree, provided it is allowed to become thoroughly moist before the determination is made.

The physical condition of organic soils was found to have a great influence on the rate at which they will take up water. A fine textured organic soil that was removed from the deposit while wet and allowed to dry in large chunks took up water very slowly. This was especially true of the lower horizons of fine textured materials. This physical condition had no influence on the amount of heat generated on wetting, but it did have an influence on the rate at which heat was developed.

A close relationship was found to exist between the heat of wetting and the capacity of organic soils for unfree water. It was apparent, however, that the ability of organic soils to develop heat on becoming wet and to hold unfree water is dependent not upon the organic content of the soil but upon the stage of decomposition and the nature of the materials. A soil with a very low organic content naturally had a low heat of wetting, but as a rule sections of the profile with a high organic content gave less heat of wetting than those at the surface, where the organic content was lower but usually more thoroughly decomposed.

Secular and seasonal changes in the soil solution, J. S. BURD and J. C. MARTIN (*Soil Sci.*, 18 (1924), No. 2, pp. 151-167).—Data obtained at the California Experiment Station are presented on the composition of the solutions displaced from seven fine sandy loam soils under conditions incidental to cropping, fallowing, and maintenance in the air-dry state for a period of eight years. Similar data from the cropped soils at the beginning and end of the ninth season and at the beginning of the tenth season of continuous cropping are also presented.

It is concluded that continuous cropping invariably decreases the concentrations of the solutions obtainable from soils by water displacement. On the other hand, fallowing increases the concentrations of such solutions except in the case of soils in a high state of fertility. The seasonal decrease of concentration of the displaced solution characteristic of soils in general is temporary in soils which have been continuously cropped for some years, and it is thought that such solutions will increase to their initial concentrations by the beginning of the next season. The fluctuations of phosphate concentration are deemed to depend primarily upon the reaction of the soil solution, although the concentrations of certain cations are also involved.

Evidence is presented which tends to show that the qualitative composition of the soil solution in soils under crop is constantly changing. It follows that nutrient culture solutions made up in imitation of the soil solution as it exists in the beginning of the season can not represent such a solution during the later stages of the growth of crops.

The influence of water on soil granulation, G. J. BOUYOUCOS (*Soil Sci.*, 18 (1924), No. 2, pp. 103-109, figs. 3).—In a contribution from the Michigan Experiment Station a brief critical analysis of the function of water films in the production of soil granulation is presented. The general idea that the granule formation of soils is due to the pulling forces of water films as they become thinned out is considered to be incorrect. It is stated that water pushes the soil particles apart and thus produces a crumbling of dense masses or clods into a loose, granular structure. Water is able to accomplish this by swelling the colloids and by diminishing the cohesive force of the particles as it comes between them.

The heat of wetting of soil colloids, M. S. ANDERSON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9, pp. 927-935).—Studies conducted by the U. S. D. A. Bureau of Soils on the heats of wetting of soils and of colloidal material from soils are reported, the purpose of which was to determine whether such data

may be used to indicate the colloidal content of soils. The heats of wetting of the colloidal materials from different soils varied widely, but in some cases were comparable with the heat values for starch and for synthetic inorganic gels. Practically all of the heat of wetting of a soil appeared to be due to colloidal material.

It is stated that although the colloid content of a soil can not be deduced from the heat of wetting of the soil alone, a fair approximation of colloid content may be indicated by the formula, $\frac{\text{heat of wetting of soil}}{\text{heat of wetting of colloid}} \times 100$. This method is considered to be subject to some inaccuracy, due to failure to isolate a sample representative of the whole of the colloid and to alteration of the colloid through the process of extraction. On the whole, however, it is stated that the heat of wetting of soil and colloid probably indicate the colloid content of a soil about as accurately as adsorption determinations.

The influence of the removal of colloids on some soil properties, M. M. MCCOOL and L. C. WHEETING (*Soil Sci.*, 18 (1924), No. 2, pp. 99-102, figs. 2).—Studies conducted at the Michigan Experiment Station are reported which showed that the removal of colloids from two soils brought about a rise in the pH value and a decrease in the amount of lime water necessary to produce neutrality. The heat of wetting was decreased, as was also the amount of water held in combined form. The amounts of capillary adsorbed and free water were increased.

Note on the absorption of bases by soils, N. M. COMBER and S. J. SAINT (*Soil Sci.*, 18 (1924), No. 2, pp. 131, 132).—In a brief contribution from the University of Leeds, experiments are reported which showed that the amount of carbon dioxide evolved when normal alkali carbonates react with soil is not a measure of the amount of base absorbed.

Alkali soil investigations, III, IV, J. S. JOFFE and H. C. MCLEAN (*Soil Sci.*, 18 (1924), Nos. 2, pp. 133-149; 3, pp. 237-253, fig. 1).—The third and fourth contributions on the subject from the New Jersey Experiment Stations are presented (E. S. R., 52, p. 116).

III. Chemical effects of treatments.—Experiments are reported which showed that a sulfur treatment of 2,000 lbs. per acre is not sufficient to bring about a complete transformation of the alkali soils used. Alum had some merit, especially in combination with sulfur. The evidence obtained seemed to indicate the calcium-sodium character of the particular alkali soil studied.

IV. Chemical and biological effects of treatments.—Data on the chemical and biological effects of treatments of alkali soils are reported. It is stated that the combination effects of sulfur and alum in ameliorating the physical condition of the soil suggest the possibility of the use of these two materials in treating alkali soils. The use of organic substances such as peat or large amounts of manure are also said to be effective, inasmuch as they serve as buffers and constituents to be reacted upon by the soda. However, since they have no cations capable of replacing the noxious cations of the zeolitic portion of the soil their effectiveness is only temporary. Other data show the influence of such treatment on the bacterial activities of alkali soils and on the production of vegetation.

A progress report of alkali land reclamation investigations in eastern Oregon, W. W. JOHNSTON and W. L. POWERS (*Oregon Sta. Bul.* 210 (1924), pp. 4-27, figs. 13).—The progress results of tank and field experiments conducted for four seasons with natural black alkali soils which were only slowly permeable to water are reported.

Leaching alone was found to be effective in removing the neutral salts, but was not effective in removing sodium carbonate or in improving the physical condition of the soil. Leaching and drainage in connection with chemical treatment were found necessary in order to remove the neutral salts resulting from the decomposition of sodium carbonate.

From 7 to 10 tons of gypsum per acre were required to neutralize the sodium carbonate sufficiently to secure a good stand of sweet clover. The application of 500 lbs. of sulfur with 20 tons of manure per acre made it possible to secure a fair yield of rye and a good stand of sweet clover. It was indicated that heavier applications of sulfur alone would be effective. Five tons of aluminum sulfate per acre were required to soften the soil, lighter applications being ineffective. Manure was effective when used in combination with sulfur and gypsum, but not when used alone.

The tank experiments verified the field results, and indicated the value of heavy gypsum, sulfur, and alum treatments.

Sunlight and chemical nitrification [trans. title], J. ŻÓŁCIŃSKI (*Rocz. Nauk Rolnicz.*, 10 (1923), No. 2, pp. 311-332).—Experiments are reported which showed that a chemical nitrification took place in an aqueous ammoniacal solution of humus under the influence of sun rays. This nitrification did not occur in the dark, and the nitrate formed in the sunlight disappeared in the dark after a short time.

A discoloration of the humus substance accompanied chemical nitrification. Quartz containers were more favorable to chemical nitrification than glass containers. The process was much more slow in ammonia solutions of natural humus than in solutions of prepared humus. The presence of aluminum hydroxide in the solutions hastened nitrification. No chemical nitrification was found to occur in prepared ammonia solutions of other colloidal organic substances such as starch and gum arabic.

Practical applications of these results by others are noted.

Conservation of the soil [at the Kansas Station] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 24-30).—A few of the results of investigations in soil conservation at the station are enumerated, including those in soil fertility, tillage investigations, and data from the soil and crop experimental fields.

[Soil studies at the Illinois Station] (*Illinois Sta. Rpt.* 1923, pp. 11, 12).—It is stated that from the standpoint of nitrate accumulation and crop production the plowing under of sweet clover when from 8 to 10 in. high is as satisfactory as much later plowing. Data from 34 soil fertility experimental fields located in various parts of the State are very briefly summarized, the outstanding results of which for the season were those secured from the use of **organic manures** either in the form of farm manure or legumes and usually with limestone.

Green-manuring crops for soil improvement, A. G. McCALL (*Maryland Sta. Bul.* 268 (1924), pp. 12, figs. 2).—The results of studies at Branchville, begun in 1914 to determine the extent to which green manuring crops will furnish the nitrogen and organic matter necessary to restore a tight silt loam soil with a slight hardpan and poor natural drainage to a fair state of fertility without resorting to stable manure or commercial nitrogen, are reported. The experiment was divided into two projects, one of which was designed to determine the comparative value of crimson clover, hairy vetch, red clover, and alsike clover for soil improvement, and the other designed to obtain a comparison between cowpeas, soy beans, and buckwheat when used as green manuring crops.

The results of the 5-year test showed that crimson clover used as a green manure crop produced an average increase of 2.2 bu. in the wheat crop and 6.4 bu. in the corn crop. In the same test cowpeas gave decidedly larger increases than soy beans. Of the nonlegumes used, buckwheat gave satisfactory results. Single plats of alsike and of red clover also gave satisfactory increases in the yields of wheat and corn. In all these tests the use of lime was found to be an essential factor in securing profitable results with green manure crops.

The comparative effects of additions of nitrogen, phosphorus, and potassium on the nitrogen economy of a Wooster silt loam soil, V. H. MORRIS (*Soil Sci.*, 18 (1924), No. 2, pp. 87-97).—Studies conducted at the Ohio Experiment Station are reported which showed that cropping a Wooster silt loam soil to a 5-year rotation of corn, oats, wheat, clover, and timothy for 30 years resulted in an average loss of 22 per cent of the original supply of soil nitrogen, regardless of fertilizer treatment. Limed soil lost, on the average, nearly as much as unlimed soil, and the tendency during the last 10 years of the period was for the limed soil to lose nitrogen faster than the unlimed soil. Fertilizer treatments resulted in a conservation of nitrogen directly proportional to the amount of increase in crop production due to the fertilizer treatment. Liming increased the amount of nitrogen conserved by most fertilizer treatments.

[Soil fertility studies at the Kentucky Station] (*Kentucky Sta. Rpt.* 1923, pt. 1, pp. 21-25).—A comparison of inoculated sulfur and rock phosphate with the uninoculated mixture and with acid phosphate with and without limestone showed that the inoculated mixture produced a larger yield than the uninoculated mixture and acted very much the same as acid phosphate.

Studies on the influence of sulfur and gypsum on the availability of soil potassium showed that in the sulfur treatments the water extract contained more potassium than that of the controls in every instance. However, with the gypsum treatments this was true in only one case. On treating the extracted soils with 0.2 N nitric acid less potassium was dissolved in nearly every instance than was taken from the original soil by this solvent, and the sum of the amounts obtained by successive extraction with water and with 0.2 N nitric acid was about equal to the amount dissolved by 0.2 N nitric acid from the original soils. This is taken to indicate that the increased amount of water-soluble potassium following the sulfur treatment may have resulted from the action upon potassium compounds by the sulfuric acid formed by the oxidation of the added sulfur.

Extraction of the soils with 0.1 molar solution of ammonium nitrate dissolved more potassium in 19 out of 21 cases than did extraction with 0.2 N nitric acid. Five out of 7 of the sulfur treatments and 3 out of 7 of the gypsum treatments yielded more potassium to the ammonium nitrate solution than did the controls. Apparently the increasing acidity resulting from the sulfur treatments was inimical to the growth of wheat plants, and prevented them from using the liberated potassium.

Further data are presented on soil solution and soil bacteria, H-ion concentration studies on soils, and the results from the soil experimental fields.

The 5-year rotation fertilizer experiment, C. E. THORNE (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7-8, pp. 119-123).—A brief summary of the results of a 5-year rotation fertilizer experiment is presented.

The manuring of market garden crops, B. DYER and F. W. E. SHRIVELL (*London: G. Street & Co., Ltd.*, 1924, new ed., pp. 148, figs. 21).—An account is given of field manuring trials begun in 1894 on the growth of market garden crops up to the year 1916. The work consisted mainly of an inquiry as to how far the large quantities of purchased stable manure used by market gardeners are necessary.

The results as a whole indicate that in soils in fairly good mechanical condition with a normal rainfall, stable manure could be dispensed with altogether for many vegetable crops, although not for all of them. It is concluded, however, that the average bill for stable manure can be largely reduced without detriment to either the size or quality of the crops, provided the diminished quantity of stable manure is supplemented with a suitable mixture of commercial fertilizer.

Greenhouse experiments with atmospheric nitrogen fertilizers and related compounds, F. E. ALLISON, E. B. VLIET, J. J. SKINNER, and F. R. REID (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 9, pp. 971-976, pl. 1).—Greenhouse experiments conducted by the U. S. D. A. Fixed Nitrogen Research Laboratory and the Bureau of Plant Industry with Norfolk sandy loam and Chester loam soils to determine the relative fertilizer value of atmospheric nitrogen fertilizers and related compounds for wheat and beans are reported. While the experiments are considered to be too limited in extent to justify general conclusions, certain indications were evident.

The green weights were not markedly different when obtained from applications of sodium nitrate, ammonium sulfate, urea, ammonium nitrate, calcium nitrate, and ammoniated superphosphate. In the first experiment cyanamide also gave yields corresponding to ammonium sulfate, but in a later experiment with wheat it was less satisfactory.

Urephos was not so satisfactory a nitrogen carrier as the other materials mentioned. Although the results with light and medium applications were rather good, those with the largest applications were considerably poorer. Guanylurea sulfate was found to be unsuitable as a nitrogen carrier. In some instances it produced fair increases in growth, while in others it either seemed to be inert or to actually retard plant growth to a considerable extent. Some indications were obtained that this material is made available slowly and might be of use to a slow-growing crop.

Dicyanodiamide injured the growth of wheat, causing a burning of the tips of the wheat blades and a retarding of growth. The injury was even more marked on beans. The toxic effects were most in evidence on the lighter soil.

Cultural tests with different nitrogenous fertilizers [trans. title], A. DEMOLON and R. MONBRUN (*Compt. Rend. Acad. Agr. France*, 10 (1924), No. 27, pp. 775-777).—Comparative tests with ammonium sulfate, ammonium chloride, sodium nitrate, and urea with oats following wheat and beets on calcareous sandy soil are briefly reported. The results showed that the ammonium chloride gave in general as good results as the sodium nitrate, and the poorest results were obtained with urea. The yields of both grain and straw were, however, increased by all four fertilizers.

Liming in western Ohio, J. A. SLIPHER (*Ohio State Univ., Timely Soil Topics*, No 77 (1924), pp. 4).—Practical information on the use of lime on soils in western Ohio is briefly presented.

Lime and its relation to crop production in Virginia, T. B. HUTCHESON and T. K. WOLFE (*Virginia Sta. Bul.* 237 (1924), pp. 20, figs. 5).—Data from different experiments at the station are presented and discussed, giving ample proof that investments in lime have paid large dividends in the State. It is not the purpose, however, to imply that lime will take the place of fertilizers or is absolutely necessary for farm profits. It is shown clearly that in most cases lime without manure or fertilizers has not been profitable. On the other hand, fertilizers have in most cases given higher returns where lime was used in the rotations than where it was not used. It is believed that where the haul is not too long, lime will make fertilizers more efficient and will give

paying results, particularly in rotations where clovers or other lime-loving legumes occupy an important place.

Some effects of sulfur on crops and soils, H. R. ADAMS (*Soil Sci.*, 18 (1924), No. 2, pp. 111-115).—Studies conducted at the Indiana Experiment Station on the influence of sulfur on the germination and early growth of clover and alfalfa and on the acidity and solubility of soils are reported. The effect of leaching on the acidity produced by sulfur treatment was also investigated. The sulfur was added to medium sand soil at rates of 0, 500, 1,000, 1,500, 2,000, and 3,000 lbs. per acre, and to silt loam soil at rates of 0, 1,500, 2,000, and 3,000 lbs. per acre.

The results showed that sulfur had little effect on the germination and early growth of the plants, except with the large applications which had been incubated for several weeks, in which cases the aboveground growth was decreased. It was found that alfalfa seed will germinate when the intensity of the acidity is too great for growth. The acidity of the soils and the amount of soluble material increased with the amount of sulfur applied and the length of the incubation period. There appeared to be a correlation between the pH values and the amount of soluble material present, this being more apparent in the sand cultures.

After reaching a certain H-ion concentration, a very slight change in acidity had a decided effect on the stand of plants. This was shown in the sand where a fair growth occurred at pH 4.3 but practically none at pH 4.1, and in the silt loam where similar results were obtained at pH 3.5 and 3.4. Since growth practically ceased in the sand at pH 4.1, while the plants grew well in the silt loam at pH 3.5, it is considered apparent that the acidity at which a plant will grow is a property of the soil and not entirely of the plant itself, and will vary with the soil used. It also appeared that this is due to some effect on the growth of the seedling and not on germination. The H-ion concentration produced in a soil by a certain treatment was also found to be controlled by the soil itself, and results on different soils were not strictly comparable. The fact that better growth was obtained on both soils with the greatest content of soluble salts was taken to indicate that the death point of the plants was not due to too great a concentration of the soil solution.

Leaching experiments with treated and untreated sand cultures showed that although the sulfate was practically all removed by leaching, the acidity produced by sulfur oxidation was not. On the contrary, leaching made the treated soils slightly more acid. Apparently the sulfuric acid reacted with the soil bases as fast as it was formed, and the increased soil acidity was due to insoluble acids or acid salts. The alkaline soil was made more acid by leaching, and the last leachings from this soil were strongly acid. Practically all of the soluble calcium was also washed from the soil, and although the untreated soil was alkaline, the first leachings from the treated soil contained more calcium than those from the untreated. There was some evidence that the treatment flocculated the colloids present, inasmuch as water percolated faster in the treated soil.

The results of lime requirement determinations made on some of the treated soils showed that, although there may be some correlation between pH value and total lime required to bring a soil to neutrality under different conditions, there is no correlation between these properties in different types of soil.

The fertilizing value of rain and snow (*Canada Expt. Farms, Div. Chem. Interim Rpt.*, 1922, pp. 61-64; *Rpt.*, 1923, pp. 11, 12).—The results for the fifteenth and sixteenth years of the inquiry into the value of precipitation as a

source of available nitrogenous crop nutrients (E. S. R., 48, p. 22) are briefly presented. These indicated that at Ottawa, Ont., an average of 7.111 lbs. of nitrogen per acre were contained in the rain and snow for the year ended February 28, 1922, and 7.413 lbs. for the year ended February 28, 1923. Summaries of the precipitation and the amounts of nitrogen contained therein for previous years are also presented.

AGRICULTURAL BOTANY

Density of cell sap in relation to environmental conditions in the Wasatch Mountains of Utah, C. F. KORSTIAN (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9, pp. 845-907, figs. 5).—On account of the possible relation between cell sap and environmental condition and the choice of sites for reforestation, the author made a study of the density of cell sap of a large number of species of trees, shrubs, and herbaceous plants in relation to their environment in eastern Utah. The investigation is said to have yielded results of direct application in forest research, in that it showed that sap density may be used as an index in correlating environmental factors with physiological responses of the plant. The concentration of the sap of a species was not found constant, but was influenced by environmental conditions which affect transpiration, the products of photosynthesis, or the supply of available soil moisture. Osmotic pressure in plants was found to be more rapidly changed by fluctuations in the moisture conditions of the site than by temperature or light.

The author found that annual herbaceous plants which complete their life cycle before the critically dry part of the growing season, and so are not subject to drought conditions, have low sap densities. The concentration of the sap of woody species is generally higher than that of herbaceous ones. During the growing season the lowest sap densities were found to occur in those forest types which are well supplied with available moisture, whose plants are best adapted to secure it, and in which the conditions are most favorable for plant growth. On the other hand, the highest densities occur on the most adverse sites. In the winter considerable variation in sap density was observed, in some cases completely reversing the densities observed during the growing season. In the case of evergreen shrubs, the conversion of starch to sugars was found to materially increase the density of the sap. A thick leaf having a compact structure tends toward a lower sap concentration through its reduction of water loss from the leaf. Epidermal coverings and hairs on the leaves also tend to produce lower sap densities. Greater sap densities were usually found in the more drought-resistant species.

A reference list is given of 121 titles cited in the report.

Experimental control of growth factors in plants [trans. title], P. BRANSCHIEDT (*Bot. Arch.*, 4 (1923), No. 3, pp. 181-195, fig. 1).—Various modifications, experimentally produced, are described, with discussion of theoretical bearings.

Growth acceleration in plants under decreased oxygen pressures [trans. title], M. HEUMANN (*Bot. Arch.*, 4 (1923), No. 6, pp. 413-443, figs. 4).—Plants growing under altered oxygen pressures are influenced as to development in their different parts in ways which are indicated for both monocotyledons and dicotyledons. The observed growth alteration (enlargement), whether in leaf or stem, is regarded as a pathogenic phenomenon brought about by what is called oxygen hunger. This leads to a reaction of the plant and results in growth with consequent increase of surface, tending to alleviate the existing condition of oxygen deprivation.

The growth factor carbon dioxide [trans. title], P. SPIRGATIS (*Bot. Arch.*, 4 (1923), No. 5, pp. 381-403, figs. 11).—The operation of the significant factor in

the carbon dioxide growth complex is not constant, but becomes more important with increase of light. This shows the need for exact light measurements at all times in connection with growth experiments. Atmospheric carbon dioxide is said to be, in the climate here in question, sufficient under normal conditions for the production of maximum crops. Cultivated plants appear to have become fully adapted to the carbon dioxide content of the air.

Absorption of carbon dioxide the first step in photosynthesis, H. A. SPOEHR and J. M. MCGEE (*Science*, 59 (1924), No. 1536, pp. 513, 514).—After calling attention to the fact that plant tissues are capable of absorbing carbon dioxide in quantities considerably greater than can be accounted for by the solubility of the gas in the water of the tissues, the authors give some results of their experiments on the absorptive capacity of dried leaves. Dried and powdered sunflower leaves, to which the same amount of water was added as originally in the leaves and which had been freed of carbon dioxide, absorbed 4.95 mg. carbon dioxide per gram, or more than 10 times the amount dissolved in the water present. Leaf material exhibiting high absorptive capacity also had a high rate of postmortal respiration and vice versa. Extraction of the dried leaves with cold water reduced somewhat the absorptive capacity of the leaf material, while extraction with cold absolute alcohol greatly reduced the absorptive capacity. When extracted with water saturated with ether the absorptive capacity was reduced 90 per cent.

The authors are of the opinion that their experiments show that the leaf absorbs carbon dioxide from the atmosphere by a mechanism similar to that by which the blood of mammals serves in freeing the tissues of this gas. It is thought that in the leaf probably the major portion of the carbon dioxide is absorbed by the proteins on the basis of the carbamino reaction. The effect of this is to increase the concentration of the carbon dioxide in the cells and to alter the form in which it is present. Their experiments on the action of ultra-violet light on the simpler carbamino acids have led to negative results. The primary union of carbon dioxide with the proteins of the leaf as the first chemical step in photosynthesis is considered of importance in determining the cause for the asymmetric nature of the synthesis of the carbohydrates in the chlorophyllous plant.

The reciprocal quantitative relation between carbohydrate and water content in foliage leaves [trans. title], T. HORN (*Bot. Arch.*, 3 (1923), No. 3, pp. 137-173).—It is claimed that in wilting leaves of *Tropaeolum majus* a causal relation holds between water decrease and starch decrease. The starch is changed to sugar, which increases as a whole, the cane sugar increasing from the first and the hexose only after a period of drying. On increasing the water content a reversal of the process could be demonstrated only for the sucrose, which varied inversely with the water content. Other indications are presented, with suggestions.

Brownian molecular movement in the plant world [trans. title], H. NEUMANN (*Bot. Centbl., Beihefte*, 40 (1923), 1. Abt., No. 1, pp. 141-160).—The author concludes that from unicellular algae to the highest plant families Brownian molecular movement is demonstrably present in every organ. Favorable demonstration media are indicated. The motion may be influenced by varying either temperature or viscosity of the (vegetable) medium.

Studies on nutrition in green semiparasites [trans. title], S. KOSTYTSHEV ET AL. (*Bot. Centbl., Beihefte*, 40 (1924), 1. Abt., No. 3, pp. 351-373).—The authors find that the photosynthetic work in some green semiparasites (*Rhinanthaceae*) is as energetic as that of autotrophic plants in the same family. The *Rhinanthaceae* take from their hosts principally water, this being indis-

pensable for the semiparasites, and the water uptake from the soil by their roots being insufficient for their normal needs. The uptake of organic materials plays no important part.

Storage of nitrogen in bark parenchyma [trans. title], A. KERN (*Bot. Centbl., Beihefte*, 40 (1923), 1. Abt., No. 1, pp. 137-140).—Studies involving changes in nitrogenous materials in *Betula alba*, *Alnus*, *Populus*, *Acer*, and *Salix* showed in the bark parenchyma of each a strongly light-refractive content for many cells. The content in labile nitrogenous compounds is much less in summer than in winter.

The function of manganese in plants (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 20, 21*).—In continuation of experiments previously reported (E. S. R., 49, p. 520) an account is given of a series of sand cultures, in which several species of plants were grown in acid-proof stoneware jars. The results obtained showed that the plants do not mature in sand cultures containing the common plant nutrients but without manganese, whereas under conditions similar except for the addition of a little manganese compound they grow normally. The work reported upon is held to confirm the conclusion drawn from previous experiments that manganese is one of the elements necessary to the normal growth of green plants, and that it functions in minute quantity. In connection with this work some evidence was obtained to indicate that possibly some other metal or combination of metals may function in the same way.

The beneficial effect to wheat growth due to depletion of available phosphorus in the culture media, W. F. GERICKE (*Science*, 60 (1924), No. 1552, pp. 297, 298).—The author reports exceptionally good growth of wheat seedlings after four weeks in complete nutrient solutions and then transferred to culture media that contained all the essential nutritive salt elements except phosphorus. Wheat grown an equal length of time from the early seedling stage in nutrient solutions devoid of phosphorus made very little growth. It is believed, therefore, that while phosphorus is needed in the early growth of wheat, it is not only useless but relatively harmful if present in appreciable quantities in physiologically available form in the culture media for the later stages of growth.

The author believes from this investigation that some nutritive elements may be required at certain phases of growth and not at others, or that they may be beneficial at certain phases of plant development and relatively harmful at other times.

[Influence on crops of boric acid and other substances in small proportions in soils] (*Rothamsted Expt. Sta., Harpenden, Rpt. 1921-1922, p. 15*).—W. Brenchley has studied the influence of manganese on crop production, and it has been shown recently by K. Warington that broad beans and certain other leguminous plants die prematurely unless they receive a small quantity of boric acid in addition to the so-called complete plant food. The results suggest that some of the anomalies and unexpected failures in fertilizer experience may be traceable to the absence of some of these substances, required in homeopathic doses only, but this work is still a long way from practical application, and it is concluded that no trust should be placed in catalytic or radioactive fertilizers as furnishing something outside the usual fertilizer constituents. Tests of several supposedly radioactive fertilizers have failed to show beneficial results.

Symbiosis of plants as a chemical problem, II [trans. title], J. ZELLNER (*Bot. Centbl., Beihefte*, 40 (1923), 1. Abt., No. 1, pp. 1-13).—Since the 1912 contribution (E. S. R., 29, p. 323), the author has continued the systematic study

of plant symbiosis, and he presents herein results of studies on two groups, one including parasitic plants poor in chlorophyll and saprophytes, the other including parasitic plants having chlorophyll and half-parasites. The results are detailed. He is convinced that plant symbiosis is so complicated a problem that its consideration chemically can contribute only a small portion of the knowledge which is needed. This calls for simultaneous anatomical, physiological, and chemical treatment.

Resin formation in conifers [trans. title], A. FRANCK (*Bot. Arch.*, 3 (1923), No. 3, pp. 173-184, figs. 5).—Brief details are given of particular changes and relations observed in a study of resiniferous portions of several conifers.

The anatomy of resin ducts in *Pinus silvestris* [trans. title], E. MUENCH (*Bot. Arch.*, 4 (1923), No. 3, pp. 195-200, figs. 2).—This article relates in part to that by Franck, above noted.

Alkaline reaction of the cotton plant, J. E. MILLS (*Science*, 60 (1924), No. 1551, p. 268).—The author reports that crushed leaves and stems of young cotton plants apparently gave no alkaline reaction. When the unbruised plant was placed in water containing phenolphthalein it was found that the under side of the leaf, the tender buds, and very tender stems showed distinct alkaline reaction. No evidence of such alkalinity could be observed on the upper side of the leaf or on the older parts of the stems.

Leaves of 30 or 40 different species of plants were examined in a similar manner, and okra, a near relative of the cotton plant, gave a similar though less pronounced reaction. The author raises the question as to whether the alkalinity observed has anything to do with the preference of the boll weevil for the cotton plant.

Stinging crystals in plants, D. A. HERBERT (*Science*, 60 (1924), No. 1548, pp. 204, 205).—From a study of several species of Philippine plants that have calcium oxalate crystals in their tissues and which cause irritation when applied to the skin, the author concludes that the action consists of two distinct stages: (1) The mechanical action of the raphides in piercing the skin and (2) the entrance through the minute wounds of a proteolytic enzyme which is the cause of the greater part of the effect.

The removal of the crystals by filtration or the destruction of the enzyme will not eliminate all the irritating properties, but the two actions together are sufficient, and so the action must be regarded as being produced by combination of the two factors.

Waxy endosperm in New England maize, P. C. MANGELSDORF (*Science*, 60 (1924), No. 1549, pp. 222, 223).—The occurrence of seeds with waxy endosperm is reported in Connecticut in ears of hand-pollinated Sanford White Flint corn. This phenomenon has previously been reported only from several localities in Asia.

GENETICS

Human inheritance, T. H. MORGAN (*Amer. Nat.*, 58 (1924), No. 658, pp. 385-409).—Brief reviews of certain phases of Mendelian inheritance in *Drosophila*, plants, and animals are given, followed by a discussion of the operation of Mendelism in human inheritance.

Studies in animal reproduction and inheritance (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 116-118).—This is essentially a brief progress report of studies of the inheritance of characters in guinea pigs, rats, and rabbits. Some difficulties have been experienced in maintaining a constant ration through the year, since alfalfa grown outdoors was apparently superior to sprouted oats as green

feed. Oats sprouted in the summer tended to rot. One important reason for getting a constant ration was to determine whether seasonal differences in the sex ratio of guinea pigs are due to feed or temperature.

Studies of inheritance in the grouse locusts (Tettigidae) (*Kansas Sta. Bien. Rpt. 1923-24, pp. 118, 119*).—In the experiments on inheritance in grouse locusts, several new factors have been added to the series. Cages of *Paratettix texanus* and *Apotettix eurycephalus* kept at a temperature of 90° F. and a humidity of 73 per cent have not shown any evidence of the effect of temperature on inheritance.

Permanence of tree performance in a clonal variety, and a critique of the theory of bud mutation, K. SAX and J. W. GOWEN (*Genetics, 8 (1923), No. 3, pp. 179-211; abs. in Maine Sta. Bul. 315 (1923), pp. 102-105*).—An attempt by the authors to analyze the normal variation in yield of common fruit trees, more particularly apple, is presented. The methods used were those employed in ordinary biometrical practice, the work up to 1919 being done under Surface (E. S. R., 34, p. 829).

The authors emphasize the relative part played by environmental fluctuating factors and factors which control the permanence in yield of trees of a clonal variety. The percentage of variation remaining for the permanence in variability is for the (obviously highly selected) data on the Washington Navel orange 67 per cent, for the Valencia orange 86, for the Lisbon lemon 78, for the Rome apple trees 86, and for the Ben Davis apple trees 85 per cent. Excluding the first of these, as of doubtful value, only from 14 to 22 per cent of the variability in yield is due to factors causing permanence in yield. Variable stocks and inherent differences in scions are the important known factors which may cause such permanent differences, and if differences in stocks cause much of this remaining variability, other factors, as bud mutation, can play little part in causing permanent differences in yield of trees of a clonal variety.

The relative effect of various factors in causing variability in yield of trees, as determined for the Ben Davis orchard which was studied, showed that about 62 per cent of the variability is due to environmental factors other than soil and 18 per cent to soil heterogeneity. Only about 15 per cent of the variability can be attributed to factors which cause permanence of yield; that is, grafting stocks, bud mutation, and unknown factors.

The place of stocks in the propagation of clonal varieties of apples, K. SAX and J. W. GOWEN (*Genetics, 8 (1923), No. 5, pp. 458-465, fig. 1; abs. in Maine Sta. Bul. 315 (1923), p. 97*).—This contribution is a more technical presentation of the material noted in Bulletin 310 (E. S. R., 50, p. 37).

Mutations of the potato, D. FOLSOM (*Jour. Heredity, 14 (1923), No. 1, pp. 45-48, figs. 3; abs. in Maine Sta. Bul. 315 (1923), pp. 107, 108*).—Two somewhat unstable leaf forms of the potato are briefly described. These are not to be classed with the symptoms of degeneration diseases previously noted (E. S. R., 44, p. 449), but are regarded as sports. The two types here reported appear to be somatic mutations in a clonal variety, and have been so unstable as to revert in part to the varietal norm. The five cases described were the only ones found in more than 350,000 plants observed for foliage diseases.

A simple-leaf sport of the Green Mountain variety, observed in 1920 and grown in greenhouse and field, partly reverted to a compound-leaf condition by 1922. Of four thick-leaf sports observed in four different Maine fields, one is here discussed as observed from 1918 to 1922. This showed a range from absence to completeness of sporting among the various hills, among the various leaves of one hill, and even among the leaflets of a single leaf. The

thick-leaf type of sport, though probably occurring more frequently than the simple-leaf type, is somewhat less stable.

A genetic and cytological study of certain hybrids of wheat species, K. SAX and E. F. GAINES (*Jour. Agr. Research* [U. S.], 28 (1924), No. 10, pp. 1017-1032, pls. 2).—The sterility, genetics, and cytology of a number of wheat species crosses, Marquis×Kubanka, Hybrid 143×Alaska, Marquis×Alaska, Hybrid 143×Polish, and Amby×Kubanka, were studied cooperatively by the Maine and Washington Experiment Stations.

Crosses between wheat species of the emmer group with 14 chromosomes (Polish, Kubanka, and Alaska) with members of the vulgare group with 21 chromosomes (Marquis, Amby, and Hybrid 143) were seen to result in partially sterile F_1 hybrids and in all degrees of sterility in F_2 . Previous cytological studies (E. S. R., 50, pp. 26, 27) of chromosome number and behavior in F_1 and F_2 indicated that gametes and segregates with an intermediate chromosome number tend to be eliminated through sterility, and that ultimate homozygous fertile segregates will have either 14 or 21 chromosomes. Segregates with 14 resemble the emmer parent in most respects, while those with 21 have most of the vulgare characters, suggesting that the 7 additional chromosomes determine the differentiating characters of the vulgare wheats. The combinations of typical emmer and vulgare characters in certain segregates are thought to indicate that the differentiating vulgare characters are determined by factors in individual chromosomes and not by the combined effect of the additional 7.

Certain combinations of emmer and vulgare characters occur in segregates with 14 or 21 chromosomes, and probably a small proportion of segregates combining certain characters of the two groups of species can be obtained, especially in the more fertile combinations. From a practical standpoint, however, it would probably be more feasible to combine disease resistance and yield and quality of grain by selecting the parents within the vulgare group.

Inheritance of white seedlings in maize, M. DEMEREC (*Genetics*, 8 (1923), No. 6, pp. 561-593).—It appears that white seedlings, frequently found in the commercial varieties of maize, are determined by many genetically different factors. At least seven different genes for white seedlings were found, and indications are very strong that there are many more. "Three of these factors are single Mendelian recessives. Two others are duplicate genes. The progeny of a selfed plant which is heterozygous for both of these genes segregates into a 15:1 ratio. The remaining two factors are also duplicate genes. The indications are strong that they are linked together with about 36.9 per cent of crossing-over. Segregation into a 63:1 ratio was observed among the progenies of two unrelated stocks. This ratio suggests the existence of triplicate genes. The relation between these genes and those mentioned above is not known."

[Inheritance in dairy cattle] (*Illinois Sta. Rpt. 1923*, p. 20).—In continuing the studies of heredity in the Guernsey-Holstein herd (E. S. R., 49, p. 375), 47 F_1 animals have now completed at least one lactation. The mean fat percentage of the milk was 4.36 per cent as compared with 3.44 per cent for Holsteins and 5.03 per cent for Guernseys. The milk produced by F_2 animals averaged 4.43 per cent. From 126 matings of Holstein and Guernsey cattle, 119 black and white and 7 red and white offspring were produced, the latter type all coming from 3 Holstein cows, which were thus heterozygous for black.

The inheritance of a retinal abnormality in white mice, C. E. KEELER (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 7, pp. 329-333, figs. 3).—The absence of

the visual cells, the external nuclear layer, and the external molecular layers from the retina of the eyes of white mice is described from the zoological laboratory at Harvard University. A preliminary study of the mode of inheritance of this abnormality has indicated that it is transmitted as a simple Mendelian character recessive to the normal. The study was made by removing one eye from the mice and sectioning it.

On the large Swiss pedigree in which nyctalopia is inherited with myopia [trans. title], W. KLEINER (*Arch. Rassen u. Gesell. Biol.*, 15 (1923), No. 1, pp. 1-17, figs. 5).—The inheritance of night blindness in a pedigree is shown to be sex linked and probably due to a recessive Mendelian factor, though certain other modifying factors may be operative.

A study of the inheritance of the characteristics in which the Single Comb White Leghorns and the Jersey Black Giants differ (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 106, 107).—Crosses between these breeds have indicated that the difference in rate of feathering is due to a single sex-linked factor. The behavior of a total of 10 contrasting characters is being noted in these crosses.

Experiments with certain plumage colour and pattern factors in poultry, W. E. AGAR (*Jour. Genetics*, 14 (1924), No. 2, pp. 265-272).—In studying the inheritance of various color and pattern characters in poultry at the University of Melbourne, crosses were made between Rhode Island Red hens and Barred Plymouth Rock roosters and between Barred Plymouth Rock hens and Golden Laced Wyandotte roosters.

In each experiment F_1 males heterozygous for both the sex-linked factors gold and barring were back-crossed with silver nonbarred hens. In a total of 28 offspring produced in the Wyandotte experiments, 5 were gold and nonbarred and 5 were silver and barred, thus indicating 35.7 per cent crossing-over between these two factors. Due to the restriction of black in the Rhode Island Red crosses some of the results were uncertain, but the crossing-over reported was 46.4 per cent. Brief reports of investigations of other characters are also given, in which lacing was found to be due to a recessive autosomal factor *l* and spangling to a recessive sex-linked factor. The appearance of a color designated as chestnut is described but not analyzed.

Color factors in bean hybrids, K. SAX and H. C. MCPHEE (*Jour. Heredity*, 14 (1923), No. 5, pp. 205-208, figs. 2; *abs. in Maine Sta. Bul.* 315 (1923), p. 100).—Bean breeding experiments at the Maine Experiment Station during the past decade have shown some rather unusual results with eyed beans. In crosses of Old Fashioned Yellow Eye beans with Improved Yellow Eye beans, the segregation in the second generation indicates that only a single pair of allelomorphic factors is involved. Though usually a single pair of allelomorphic factors results in a character intermediate between the two parents, or resembling one or the other, in the present cross the factors in a heterozygous condition not only cause a great increase in the area or amount of pigmentation but cause also an entirely new eye pattern.

Crosses of eyed with white beans have given various types of segregation in the second generation. When two extension factors are present one factor may extend one class of pigments while the other extends another pigment, so that an eye pattern on a solid or a mottled background may result. Numerous types of mottling also are found. The mottled pattern may consist of small irregular patches on a pigmented background, or the background may be white. Several mottling patterns may be superimposed on one another. The patches may be of various shapes and sizes, or may be associated with

sunken seed coat areas. Uniformly pigmented beans may show variability in pigment color. In the second generation, eye pigmentation patterns may range between 90 per cent and a mere dot at the end of the hilum. A parental type was rarely recovered, if ever.

Factors for seed weight are also associated with factors for pigmentation, eye pattern, and extension. It is estimated that about five or six size factors must be involved in most of the crosses studied. These size factors are independent in their effect, and since they are often closely linked with factors for qualitative differences the effect of single factor differences for size can be studied.

The association of size differences with seed-coat pattern and pigmentation in *Phaseolus vulgaris*, K. SAX (*Genetics*, 8 (1923), No. 6, pp. 552-560; *abs. in Maine Sta. Bul.* 315 (1923), pp. 101, 102).—"Crosses between certain eyed (partially pigmented) and white beans resulted in completely pigmented mottled beans in F_1 and mottled, self-colored, eyed, and white beans in F_2 . Mottling is dependent on two factors in the same linkage group, both of which are necessary to produce mottling. Completely pigmented beans are dependent on either one or two extension factors, the recessives of which result in eyed beans. Pigmentation is dependent on a single factor.

"In all crosses of large pigmented beans with small white beans the pigmented F_2 segregates had a mean seed weight greater than that of the white segregates. In the cross Improved Yellow Eye \times White 1228 the difference in average seed weight between homozygous pigmented F_2 segregates and white segregates was found to be about one-sixth of the F_2 range. The difference between the weight of heterozygous pigmented F_2 segregates and white segregates is only about half as great as the difference between homozygous pigmented individuals and the white segregates. Thus, a size factor (or group of closely linked factors) in the 1 n or heterozygous condition has only about one-half of the effect that it has in the 2 n or homozygous condition. This lack of dominance is of interest in connection with the hybrid-vigor hypothesis. Factor differences for seed weight are also associated or linked with one or both of the eye factors, with eye pattern factors, and with factors which determine the color of the pigment. Size differences even in case of blending inheritance where several factors are involved may be effected by the independent action of the size factors in different linkage groups. These factors, when combined, have a cumulative effect. The size factors in different chromosomes may not be equal in their effect."

Further evidence of linkage with crossing over in *Oenothera*, G. H. SHULL (*Genetics*, 8 (1923), No. 2, pp. 154-167).—"The linkages here considered involve (a) the relation between the factor for revolute leaves (*funifolia*) and that for red hypanthia (*rubricalyx*); (b) between revolute leaves and red stems; (c) between *rubricalyx* buds and *sulfurea* flower color; and (d) between *sulfurea* flower color and *nanella* stature."

The experimental results presented here are thought to be as fully adequate as were those given in the author's Eugenics Congress paper (E. S. R., 49, p. 567) to demonstrate the regular occurrence of crossing-over in the group of *Oenotheras* with which he has been working. A failure to find chromosomes lying side by side or twisting about each other can not in any way set aside the genetical proofs that linkage with crossing-over does occur. It may, however, affect views as to the validity of the chiasmata theory of crossing-over.

"The cytological studies of *Oenothera* have thus far failed to discover a relation between the homologous chromosomes which seems favorable to the assumption that an interchange of genes between them may take place by the

method of chiasmotypy. This fact must not be allowed, however, to throw any doubt on the occurrence of crossing-over in this group, as demonstrated by appropriate breeding experiments. . . .

"The number of factors recognized as being associated together in a single linkage group is now 13, or almost twice as many as the haploid number of chromosomes. This fact makes it necessary to assume that crossing-over takes place within the single chromosome pair. The apparent cohesion of nonhomologous chromosomes is not an adequate explanation."

Selective fertilization among the gametes from the same individuals. D. F. JONES (*Natl. Acad. Sci. Proc.*, 10 (1924), No. 6, pp. 218-221).—When certain varieties of pop corn of the *Zea mays everta* type are crossed with sweet corn a deficiency in the number of recessive segregates is commonly observed when the hybrid plants are self-fertilized. Cases similar to this are indicated, notably that by Kempton (*E. S. R.*, 41, p. 437), involving waxy endosperm. The author's results are given from the cross of an inbred strain of pointed pop corn with a first generation hybrid of two inbred strains of sweet corn of different type, with mention of differences observable on comparison with Kempton's results.

"To sum up, the F_1 plants self-fertilized showed a selective action such that more of the gametes carrying the dominant factor united than would be the case in random mating. The heterozygous F_1 plants back crossed with the recessive parent showed no selective action either way the pollinations were made. Back crossed with the dominant parent there was no selective action when the pollen was alike, but the pollen from the heterozygous F_1 plants showed a markedly greater fertilizing ability on the part of the gametes carrying the dominant factor.

"This series of facts shows that the selective fertilization is not due to differences in the functioning of the pollen alone, although the differential action is exhibited only when the pollen is diverse, otherwise unequal numbers would be obtained in the back cross on the recessive parent as well as on the dominant. There is apparently an interaction between the pollen tube and the tissues in which it grows such that pollen carrying the dominant factor is better able to accomplish fertilization than the pollen carrying its recessive allelomorph only in a sporophyte which also has the dominant factor either in the haploid or diploid state.

"There is in this case a tendency among diverse gametes from the same individuals for like to mate with like just as among individuals of different germinal constitution, as has been shown by the results of pollination with mixtures of pollen from different plants. For this reason a variation occurring in a homogeneous population tends to be separated from the parent stock more quickly than would occur in random mating. Gametes carrying the aberrant gene are handicapped when mating with gametes from individuals of the original type, but not with those from the new form. In this case genetic selection favors divergent evolution."

Ovogenesis during sexual maturity as elucidated by experimental methods. G. N. PAPANICOLAOU (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, pp. 393-396).—It has been found at the Cornell University Medical College in studies of guinea pig ovaries that there is a continuous process of ovogenesis in the ovary from the time of gonadal differentiation up to the time of cessation of sexual activity in the female. Various factors influence the rate of ovogenesis, favorable nutrition, seasonal conditions, and oestral activity stimulating it, while the opposite conditions, competition in the ovary and the presence of corpora lutea, retard ovogenesis but do not stop it. The stages in the develop-

ment of ova do not always follow at the same rate, as at times there is a rich growth of ovocytes, while at other times there is a more extensive growth of follicular and luteal cells or of interstitial groups.

Sex-ratios and spermatogenesis in the top-minnow, *Gambusia holbrooki* Grd., S. W. GEISER (*Biol. Bul. Mar. Biol. Lab. Woods Hole, 47* (1924), No. 3, pp. 175-213, figs. 40).—A study at Johns Hopkins University of spermatogenesis in the top minnow, *G. holbrooki*, yielded a hypothetical explanation for the deficiency of males commonly observed in populations of this species. The sex ratios of the fish hatched from four females in an aquarium were approximately equal, but the males were found to be much less resistant to diseases, the action of chemicals, and other unfavorable environments. Males therefore have a much higher death rate, and the unequal proportion of the sexes commonly found in mature populations is explained on this basis.

FIELD CROPS

[**Field crops investigations in Illinois**] (*Illinois Sta. Rpt. 1923, pp. 12-14*).—In the 1923 crop, the high-protein strains of corn (E. S. R., 49, p. 329) averaged 16.53 per cent protein and the low-protein strains 6.48 per cent, the high- and low-oil strains 10.08 and 1.58 per cent of oil, respectively, and the high-ear strains 105.3 in. and the low-ear 13.1 in. Seed selection based on careful study of the parent plant and the ear, both as to physical characters and as to germination, promised enhanced productivity.

Further confirmation of the resistance of certain varieties of corn to chinch bugs (E. S. R., 49, p. 330) was obtained. The 3-row plat method of testing strains of winter wheat was no better than the single-row plat under existing conditions. Nothing was gained by cultivating alfalfa after each cutting. Cutting at about one-tenth bloom produced slightly higher yields than cutting during the first-shoot and full-bloom stages.

[**Report of field crops work in Kansas, 1922-1924**] (*Kansas Sta. Bien. Rpt. 1923-24, pp. 32-51, 129-133, 136, 137, 138, fig. 1*).—Among experiments (E. S. R., 49, p. 427) reported on from the station and substations are variety tests with wheat, barley, oats, corn, sorgo, grain sorghum, alfalfa, cowpeas, soy beans, and miscellaneous grasses; cultural and planting trials with corn and wheat; and fertilizer, irrigation, and pasture studies with alfalfa. Improvement work was continued with varieties, selections, and hybrids of winter wheat, oats, barley, and sorghum, and varieties of winter rye. A genetic study of aberrant and false wild types in Kanota oats is described in some detail.

Preliminary studies of the cause of differences of sorgo, milo, and their hybrids in susceptibility to chinch bug attack led to the belief that variations in amount of lignified tissue in the stem may be one of the determining factors. In a head row of Dwarf Yellow milo the proportion of green to albino seedlings was about 3:1, and further studies with self-fertilized seed from plants in this row gave similar results.

A planting experiment with corn indicated that in general, listed corn planted early germinates less and requires longer for germination than corn planted on the surface or with disk furrow openers. With a uniform stand, yields favor listing in seasons with midsummer or late summer drought, and favor one of the other methods in seasons having heavy spring and summer rainfall.

Cutting every 10 days was found sufficient to practically destroy a stand of alfalfa in a single season, and cutting every 20 days noticeably reduced the stand and vigor, substantiating earlier work (E. S. R., 44, p. 224)

wherein cutting in the bud stage was seen to greatly reduce the stand and vigor after the first year. Significant differences in stand and vigor were not observed between plats cut first in the bud stage and later in full bloom and those cut in tenth bloom and full bloom throughout the season.

In cooperative tests of the usual scope carried on throughout the State, a decided increase in yield followed where fertilizer was applied to wheat in eastern Kansas. The greatest benefit appeared to be received from phosphorus, although with both nitrogen and potash slight increases were produced. Appreciable increases in hay and grain yields followed the inoculation of soy beans. Several of the best varieties produced at the rate of 1,000 lbs. or more of seed cotton per acre in Labette County. Studies with tame pasture grasses in Cherokee County showed their high grazing capacity in comparison with common pastures, the importance of heavy seeding and of thorough seed bed preparation, the value of liming in securing stands of both grasses and legumes, and the worth of manure and acid phosphate.

The average yields during a number of years at the Fort Hays Substation indicate that, in general, fall plowing has given considerably better results than spring plowing for barley, oats, and spring wheat, whereas spring plowing was better for the row crops. All crops responded to fallow with increased yields over all other methods of seed bed preparation, but the increases did not appear enough to justify fallowing as often as every other year except perhaps with milo. Rotations including green manure crops thus far have not given yields in excess of those produced on fallow, nor did barnyard manure or commercial fertilizers increase the yield significantly. Barley sown on sorghum stubble has practically equaled barley sown on corn stubble. Early fall listing for continuous wheat has outyielded other methods.

Ten consecutive seasons of cutting alfalfa grown in rows 6 to 42 in. apart showed definitely that the wider spacing between rows was accompanied by the lower hay yields. Sorgo and Sudan grass proved much superior to millets when compared in close drilled seedings for hay production.

[**Field crops work in Kentucky, 1923**] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 29, 30, 34, 35*).—In further experiments (E. S. R., 49, p. 524), nitrogenous salts applied to tobacco after corn have given variable increases. Since root rot evidently remains in the soil for at least two years after tobacco is grown, short rotations, at least with Burley tobacco, do not seem desirable unless varieties resistant to root rot are used. Analyses of ash showed that Burley tobacco contains somewhat less crude ash, magnesium, and silicon than black tobacco, but considerably more phosphorus, potassium, and calcium. In comparing the 1920 and 1921 crops, considerable differences were found in the silicon, potassium, and calcium contents of corresponding grades, whereas the crude ash, phosphorus, and magnesium were more uniform.

The common and hardy strains of alfalfa were very similar in hay production. Field trials indicated that alfalfa can be sown successfully with small grains, if the soil has been limed and inoculated. The variable yields of wheat varieties emphasized the need of tests of some duration to determine the worth of a strain or variety. The best yields on rotation plats where wheat follows various crops were obtained after tobacco and corn and the lowest after soy beans. Wheat after broadcasted soy beans yielded less than after soy beans in cultivated drills. No decided increase was obtained from any application of nitrogenous fertilizers given wheat.

[**Field crops investigations in Montana**], C. McKEE, W. O. WHITCOMB, D. HANSEN, A. OSENBRUG, and G. MORGAN (*Montana Sta. Rpt. 1923, pp. 16-19, 40-42, 44-47, 50-57, 59-61, figs. 19*).—Experiments with field crops are reported

on as heretofore (E. S. R., 50, p. 133). The leading varieties of spring and winter wheat, sunflowers, corn, and root crops at the station and substations are given with their acre yields, and the comparative hay production of small grains and millets and of sweet clovers planted with and without nurse crops are set forth. Growing sunflowers continuously for 3 years on the land did not reduce the yield of the subsequent wheat crop below that of wheat following three continuous crops of corn. Comparative germination tests during 4 years demonstrated that the smaller the seed, the greater does the laboratory germination exceed the field test. Oats, barley, rye, and wheat gave differences ranging from 14 to 20 per cent, while alfalfa and the clovers differed from 33 to 47 per cent.

The tabulated results of a 4-year period at the Huntley Substation show that maximum yields of sugar beets and of oats were had in irrigated rotations including alfalfa, and other crops following alfalfa in rotations showed equally favorable returns. Without irrigation, corn made its highest yields on fallow, and in continuous culture, on spring listed land.

Experiments at the Judith Basin Substation seemed to show that under the soil and climatic conditions of this region, the reduction in wheat yield in continuous cropping is largely due to the increase in weeds that interfere with the growth of the crop and use its moisture and plant food. A cumulative effect from the use of barnyard manure on dry land crops was observed, particularly after the first 10 years. The largest benefits followed applications of the manure to fallow land or to a cultivated crop the year preceding the small grain crop on the same land. During 4 years furrow-drilled wheat gave an 89 per cent stand and averaged 28.3 bu. per acre, while wheat from the ordinary drill made 62 per cent and 22 bu. The furrow drill gave maximum yields with 4 pk. of seed and the ordinary drill with 5 pk.

Cereals on spring plowing have outyielded those on fall plowed land, and crops grown on summer fallowed land have yielded more than when grown under any other method of soil preparation at the North Montana Substation. The forage yields of Sixty Day oats, Banner oats, and Marquis wheat did not differ greatly. Banner oats made more hay from an early planting than later. On spring plowed flax stubble, sorgo made its largest forage yield when planted July 1 in close drills, and Sudan grass June 1 in 3-ft. rows.

Dry-farm crop rotation experiments at Moro, Oregon, D. E. STEPHENS (*Oregon Sta. Bul.* 209 (1924), pp. 5-45, figs. 2).—Rotations carried on at the Moro Substation since 1911 and 1912 are described, with discussion of the yield and merits of the several crops included therein. Related phases of this work have been described in earlier notes (E. S. R., 47, p. 533; 51, p. 739).

Substitution of suitable rotations for the present practice of growing wheat after fallow is held to promise to maintain soil fertility better, to control weeds and disease, to distribute better and reduce labor, to reduce crop risks and hazard of low prices, and to increase the total production of the farm. Low annual precipitation, lack of crops as productive as small grains, and scarcity of grazing land for livestock make the practice of crop rotation difficult in the region.

Of cereals grown after fallow, spring barley produced the highest average annual grain yield, 989 lbs. per acre, winter wheat 870, spring oats 807, and spring wheat 714 lbs. Rotations including summer fallow once in 3 years and in 4 years did not produce as high annual yields of grain as alternating spring barley or winter wheat with summer fallow. While 12 rotations have produced higher average annual grain yields per acre than winter wheat and fallow, the standard rotation, only 4 appeared to have been more profitable.

Winter wheat will probably remain the leading dry-land crop in eastern Oregon because of its high yield after fallow and because of its advantageous distribution of farm labor. Spring wheat proved slightly superior to winter wheat in crop rotations without summer fallow, although when sown after fallow winter wheat excelled. Barley, the standard feed crop in the region, produced more pounds per acre than winter wheat when grown after fallow. Oats did not yield as high as barley when grown after fallow or after corn in the rotation. Although the yields of small grain after corn and after field peas were lower than those after fallow, seed bed preparation for cereals after peas and after corn costs less than when cereals follow fallow. Corn will probably be used chiefly for pasture and silage and field peas for pasture. Potatoes proved profitable at Moro only when grown after fallow, giving low yields with high percentages of unmarketable tubers when grown after grain. While alfalfa was not included in the regular rotations, the crop did not prove profitable for seed or hay in tests at Moro, and reduced yields of cereals were obtained for two seasons after alfalfa.

Corn and soybeans, W. C. ETHERIDGE and C. A. HELM (*Missouri Sta. Bul.* 220 (1924), pp. 23, figs. 3).—Investigations carried on during seven years showed that for the best mixture of corn and soy beans both crops must be planted together in the row at the same time. Soy beans planted with corn at corn-planting time may be expected invariably to reduce the yield of corn, the reduction varying with the ratio of beans to corn in the mixture planted. Soy beans always yielded substantially in the corn, and this yield was increased by planting the beans thick and the corn thin. While the yield of beans sometimes exceeded the loss in corn, it more often equaled about 50 to 75 per cent of the loss. The results indicated that the most productive combination of corn and soy beans for average upland soil probably would be obtained by drilling in 44-in. rows at the rate of 6 lbs. of corn and 3 lbs. of beans per acre, an equivalent to 2 stalks of corn and 2 stalks of beans per check-rowed (44-in.) hill. In proportion to the area occupied, corn and soy beans mixed by alternate rows or by alternate pairs of rows greatly outyielded the crops planted separately, suggesting a method for thin dry soils on which a successful crop of corn is very uncertain.

In a 5-year feeding test the corn-soy bean combination was more valuable than corn alone, acre for acre, for fattening hogs. The substantial proportion of the beans left by the hogs could be utilized later by sheep or hogs on winter pasture. Hay yields during five years from plantings at ordinary rates on upland soil show the corn-soy bean combination to be desirable for sheep and cattle pasturage. Morse, Midwest, Haberlandt, and Mikado soy beans are advised for planting with corn for hogging down on very fertile to average land, and either Virginia or Wilson for cattle or sheep pasturage, for silage, or for hogging down on thin land.

When corn is damaged by chinch bugs the yield of the associated growth of soy beans will probably be increased, and will compensate considerably for the loss in corn. However, evidence is lacking that the soy beans will actually lessen chinch bug attacks. When the corn yield is reduced by drought, the associated growth of soy beans is similarly reduced, so that it will not provide an important compensation for the loss in corn. Although the corn-soy bean combination leaves the land more fertile than corn alone, and when completely pastured will probably return to the soil at least as much nitrogen as it used, the constant loss of nitrogen by soil erosion precludes depending upon pasturing the corn-soy bean combination as the sole means of maintaining the fertility of upland soils.

Methods and principles of root crop improvement [trans. title], J. S. FRUERGAAARD (*Tidsskr. Planteavl*, 29 (1923), No. 5, pp. 817-851, figs. 6).—This article discusses at some length methods and principles of plant breeding work, mainly with mangels, swedes, and turnips, as developed principally by L. Helweg, who began this line of work in 1899. Tabulated results of experiments show that seed from open- or cross-pollinated plants of turnips and swedes produced larger yields of roots than those secured from seed derived from self-fertilized plants.

Svalöf Brio barley [trans. title], H. TEDIN (*Sveriges Utsädesför. Tidskr.*, 34 (1924), No. 2, pp. 47-50).—The history of a new variety of 6-rowed barley is briefly given, and the results of a comparison with Skånskt, the variety from which it was derived, are presented in a table. Average yields of grain at Svalöf for several years show an increase of 6.2 per cent in favor of Brio barley. The new variety also produced a little more straw and ripened about two days earlier than the parent sort.

Comparison of Pima cotton with upland varieties in Arizona, C. J. KING, H. F. LOOMIS, and D. L. VARMETTE (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 9, pp. 937-954, pls. 3, figs. 4).—Pima Egyptian cotton was grown in comparison with a number of upland varieties at Sacaton, Ariz., from 1920 to 1923, inclusive. The active growing and flowering periods of Lone Star and Mebane appeared much shorter than those of Pima, Hartsville, Durango, or Acala, while Pima continued growth over the longest period. The upland varieties began flowering and fruiting earlier and produced more flowers during the season than Pima, but because of their more extensive shedding they matured fewer bolls. Bolls of the upland varieties were shed at an average age of about 7 days and Pima bolls 10 days in 1922 and 9 days in 1923. The mean periods of boll development recorded were 62.3 days for Pima, Hartsville 54.3, Acala 51.5, Lone Star 51, Mebane 50.5, and Durango 47.1 days. Lack of moisture at certain times seemed to reduce the boll-development period in the upland varieties.

Pima produced the highest yields of seed cotton during 1920-1922, while in 1923 no material difference was seen in the yields of the varieties. It required to make a pound of seed cotton 122 bolls of Pima, 76 of Durango, 63 of Acala, 60 of Hartsville, 56 of Mebane, and 50 bolls of Lone Star. Lint percentages ranged from 25 to 36 in the upland varieties and from 26 to 28 in Pima. The strong central stalks and upright habits of Pima, Hartsville, Durango, and Acala are considered advantageous in irrigated regions as compared with the lower and more spreading habits of growth of Mebane and Lone Star.

Cotton, W. L. BALLS (*Empire Cotton Growing Rev.*, 1 (1924), No. 2, pp. 94-106, pls. 6).—This lecture is a somewhat popular account of research (E. S. R., 50, p. 629) on the internal structure of the cotton fiber, treating of the development of the fiber, growth rings, and spiral structures.

Production of seed flax, A. C. DILLMAN (*U. S. Dept. Agr., Farmers' Bul.* 1328 (1924), pp. II+17, figs. 8).—This supersedes Farmers' Bulletin 785 (E. S. R., 36, p. 736).

[Potato experiments in Montana], F. M. HARRINGTON (*Montana Sta. Rpt.* 1923, pp. 34-37).—Studies since 1916 (E. S. R., 50, p. 135) have shown vast differences between strains of the same potato varieties in their resistance to potato diseases. From the behavior of certain lines of Green Mountain potatoes it seems possible to select and isolate strains of potatoes resistant to degeneration diseases, and to maintain in such strains yields from 25 to 50 per cent greater than in average seed stocks.

Potato seed cut and planted the same day gave decidedly better results at the station than did seed cut some days before planting. A gradual reduction in yield, due to the failure of the seed to grow, accompanied the lapse of time between cutting and planting. A comparison on irrigated and dry land of seed from 15 varieties produced on dry land and under irrigation seemed to show that with judicious watering, other conditions being equal, there is no outstanding difference between seed from either source. The closer spacings with 3 varieties under irrigation and on dry land gave the heavier yields and a smaller size of produce.

Svalöf Birgitta potato [trans. title], J. F. LUNDBERG (*Sveriges Utsädesför. Tidskr.*, 34 (1924), No. 2, pp. 51-53).—The history of this new variety, a cross between Magnum Bonum and Badera, is briefly noted, and a comparison with Magnum Superbum and Up-to-Date is reported. In a 9-year test at Svalöf, Birgitta gave an average yield of 28,579 kg. per hectare (25,435 lbs. per acre) and Magnum Superbum 23,100 kg. On a light sandy soil the average yield of tubers for four years was 28,096 kg. per hectare for Birgitta and 26,300 for Up-to-Date. The new variety also ranked high in disease resistance.

Ventilated storage for potatoes, L. M. MARBLE (*Canton, Pa.: Marble Lab., Inc.*, 1924, pp. 7+[3], pls. 14, figs. 3).—This report illustrates the application of the principles already noted (E. S. R., 51, p. 340).

Studies on the rice plant and on rice cultivation, K. V. JOSHI and M. V. GADKARI (*Bombay Dept. Agr. Bul.* 114 (1923), pp. 75, pls. 10).—Investigations at the Rice Research Station at Karjat, Bombay, were concerned with the life history of the rice plant, its response to environment, and the factors which determine the yield of grain. The progress of this work has been noted (E. S. R., 50, p. 32).

Transplanting does not seem to result in any physiological advantage to the plant conducive to an increase in yield, and it seems to be more an expedient than a requisite condition of cultivating rice. These experiments did not show that tillering is encouraged by the stimulus of root pruning in the system of transplanting, as the old root system of the plant appears to become unserviceable and the plant must develop new roots for its use.

Tillering, a factor of great economic value in rice cultivation, is largely dependent on space and plant food, and is affected to a limited extent by other agronomic factors such as the age and vigor of seedlings at transplanting and the number of plants per bunch. Too much tillering is detrimental, as it results in sterility of the tillers borne late and uneven maturity of the whole crop. Regardless of the treatment, profuse tillering is generally accompanied by a larger percentage of loss of later tillers. The girth of the stem near the ground level is shown to be definitely and highly correlated with the length of the panicle. The mother panicle is generally the largest under the usual system of planting, but certain conditions, such as extra spacing, tend to increase the size of the panicles of tillers over that of the mother culm.

Considering the experimental results, the authors suggest sowing neither deeper than 2 in. nor on the surface, and transplanting seedlings up to but not after node formation above ground in the seed bed. Thin lanky seedlings and tillered seedlings may be avoided by the optimum rate of seeding, 280 to 320 lbs. per acre of seed bed. Transplanting from 4 to 6 seedlings per bunch at a spacing of 9 by 9 in., or 6 to 8 seedlings at 12 by 12 in., seems to be the best practice for conditions in the north Konkan. Thorough puddling of the land appeared to be associated with high yield. Since the two yield factors, the number of panicles per unit area and the average yield per panicle, are inversely related, any attempt to bring about an increase in one of them is

counteracted by proportionate decrease in the other. Fertilizing, however, increases the number of panicles per unit area without decreasing the average yield per panicle. Fertilizing chiefly with nitrogenous fertilizers seems to be the only one of the factors considered by which rice can be made to yield substantially more per unit area.

Heating the water for the rice seed bed [trans. title], A. TARCHETTI (*Gior. Risc.*, 14 (1924), No. 6, pp. 94-102, figs. 5).—Heating by electricity the water destined for rice seed beds for transplanting resulted in increased size and vigor of seedlings as compared with those grown without heating the water. The proper circulation of the water appeared to be a problem.

Summary of some experiments conducted with sugar cane and of soil and other chemical analyses from 1902 to 1923, H. T. EASTERBY and G. R. PATTEN (*Queensland Bur. Sugar Expt. Stas. Bul.* 4 (1924), pp. 94, figs. 8).—Information already reported from other sources (*E. S. R.*, 50, p. 738) is assembled.

Studies of imported varieties of sugar cane [trans. title], W. E. CROSS (*Rev. Indus. y Agr. Tucumán*, 14 (1923-24), No. 7-8, pp. 89-108, figs. 4).—The characteristics, resistance to diseases, and analyses are given for varieties of sugar cane obtained from different world regions and tested recently at Tucumán.

The cultivation of sugar cane in Queensland, H. T. EASTERBY (*Queensland Bur. Sugar Expt. Stas. Bul.* 3, 2. ed., rev. (1924), pp. 48, figs. 14).—This is a revision of a bulletin noted earlier (*E. S. R.*, 44, p. 438).

Yields of wheat following potatoes and the relation of nitrates in the soil to these, F. A. WELTON and V. H. MORRIS (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 8, pp. 519-534, figs. 6).—Comparison of yields in rotations at the Ohio Experiment Station confirmed the opinion of farmers that on the average, wheat following potatoes produces higher yields than wheat after most other crops (corn, soy beans, oats, clover). Although this does not hold true every year, it occurs often enough and is sufficient to produce the results indicated. The fact that at the end of many seasons the nitrate content of potato ground is much higher than that of corn, oat, wheat, clover, or soy bean ground may account for the relatively high yields of wheat frequently obtained after potatoes. High nitrate content of potato ground may be due in part to the relatively small amount of nitrogen removed by the tubers, and in part to a fallow condition of the ground which seems to obtain during the last weeks it is occupied by the potato crop.

[Factors influencing the quality of Kansas wheat] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 23, 24, 52-58).—Analysis and milling and baking tests of wheat grown under different cropping systems and receiving different fertilizer treatments gave indications that in years with the very highest yields, wheat may have the lowest protein content and at the same time the highest acre yield of protein, and conversely in the years of lowest yield. Years of medium yields are likely to have wheat of high protein and high yields of protein per acre. Results in the rotations showed that, while weather conditions may predominate in influencing the protein content of wheat, the crop rotation is also important. The average range in protein content from county to county in any one year was about as great as the range from one crop year to another.

Tillage methods which increased the yield also apparently improved the milling quality of wheat and the baking quality of flour, although changes in protein content as affected by seasonal conditions were greater than those

induced by soil treatments. Tillage in July and August evidently produced larger yields and a higher percentage of protein, with consequently more protein per acre, than treatments given in September.

According to baking and chemical tests with samples of Kanred, Blackhull, and Turkey grown in different parts of Kansas, no one of the three varieties is generally superior to others in the State. In conditions favoring a hard wheat, Kanred and Turkey seemed to have made the better showing, but this was by no means uniform, probably due to variation in local rainfall. Blackhull appears to have characteristics of both soft wheat and hard wheats, and so far as milling quality is concerned would be suited to a region having a greater normal rainfall than a drier region in which Kanred and Turkey succeed best. Analyses of wheat varieties grown in Kansas showed local varieties to average the highest in protein, followed in order by Kharkof, Blackhull, and Kanred, but the differences were too small to be significant from the standpoint of protein alone, without considering yield.

The behavior of stored samples indicated that wheat will attain a point of moisture equilibrium in storage, about 12 per cent during 1923.

Factors which influence the quantity of protein in wheat, C. O. SWANSON (*Cereal Chem.*, 1 (1924), No. 6, pp. 279-288).—The influence of climate, rate of ripening, variety, irrigation, and soil nitrogen on the protein content of wheat and the relation of yield to protein content are discussed, with a summary of data obtained at the Kansas Experiment Station underlying some of the results recorded above.

HORTICULTURE

[**Horticultural investigations at the Illinois Station**] (*Illinois Sta. Rpt.* 1923, pp. 22, 23).—As in the preceding year (E. S. R., 49, p. 336), this report is composed of brief progress notes. The use of nitrogen, either in the form of sodium nitrate or as cowpea cover crops, continued to prove profitable in the experimental apple orchard at Neoga. At Olney, the deleterious effect of cowpea cover crops upon peach growth and production was completely offset by the application of potassium fertilizers. Properly applied lubricating oil emulsions were found effective for controlling the San José scale. The conclusion that apple blotch outbreaks are usually associated with periods of heavy rainfall or of long-continued high humidity was reached in laboratory and field studies. Apple breeding investigations have resulted in a total of 2,446 seedlings, 16 per cent of which are deemed worthy of preservation. In greenhouse studies, lettuce yields were increased following steam sterilization and the use of nitrogenous fertilizers. Phosphorus applied as a top-dressing was found of benefit to tomatoes.

[**Horticultural investigations at the Kansas Station**] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 60, 61, 67, 68).—The use of commercial fertilizers in the station apple orchard showed no beneficial results. In fact, in two of the three tests control Winesap trees averaged greater growth than fertilized trees, and in the third test, with Jonathan, the control trees occupied an intermediate position. In the face of an unusually dry spring, the leguminous cover crops proved much more satisfactory than did cereals such as rye and wheat. In the case of vetch, the soil texture was better than that beneath rye or wheat. Rate of seeding tests with vetch indicated the desirability of the use of abundant seed. Straw-mulched Delicious apple trees made a growth equal to that under any other system of management. Applications of barnyard manure to peach and cherry trees growing on impoverished soil resulted in improved vegetative and fruit bud development.

In a test of 12 tomato varieties, the Louisiana Red was most productive, followed in order by Marvel, Norduke, Bonnie Best, and White No. 9. With one exception, mulching and staking increased the yield of marketable tomato fruits.

That the pecan is comparatively hardy was indicated by the fact that trees on the college grounds were uninjured by a temperature of -21° F. occurring during the winter of 1923-24.

[**Horticultural investigations at the Montana Station**], F. M. HARRINGTON and H. THORNER (*Montana Sta. Rpt. 1923*, pp. 37, 43, 44).—A progress report (E. S. R., 50, p. 139) upon activities during the year.

Observations upon pure line selections from the Earliana and Bonny Best tomatoes showed significant differences in yield, in certain instances amounting to several thousand pounds per acre. In addition the high-yielding strains are deemed particularly valuable for upland valleys where the normal yield is considerably limited by the short growing season.

Continued work with orchard cover crops at the Horticultural Substation at Victor bore out the conclusions of earlier years, namely, that maintained clean cultivation causes serious and permanent injury to orchard trees. As previously stated, clover proved a more satisfactory cover crop than either peas or alfalfa. However, the deleterious effects of alfalfa were overcome by applications of commercial fertilizers during the first two seasons and by use of abundant irrigation.

The DeSoto, Lombard, Hanska, and Reine Claude plums, having been found hardy and productive, are recommended for the Bitter Root Valley. In mulching studies with strawberries, the mulched plants not only outyielded the unmulched but also produced larger and better shaped fruits.

Mixing emulsified mineral lubricating oils with deep-well waters and lime-sulphur solutions, W. W. YOTHERS and J. R. WINSTON (*U. S. Dept. Agr. Bul. 1217* (1924), pp. 6).—Difficulties found in rendering oil emulsions miscible with hard, deep-well waters and with lime sulfur solutions of various dilutions were overcome by the authors by adding various colloidal materials, divided into two groups, (1) those which are most effective when not heated to 170° F., such as casein, gelatin, skim-milk powder, and glue, and (2) those which are most effective when heated almost to the boiling point, such as cornstarch, laundry starch, wheat flour, and corn meal. Such materials, designated as stabilizers, are best added to the emulsion just previous to pouring it into the spray tank of dilute lime sulfur or well water. When spray materials are held for a few days, especially in the summer season, it becomes necessary to add a preservative, such as carbolic acid, to prevent fermentation.

Methods of preparation and the use of combined spray materials are discussed in detail. Properly prepared combinations of oil emulsions and lime sulfur solutions are deemed reasonably safe for both citrus vegetation and fruit, and in competent hands are highly effective against scale insects, white flies, and rust mites.

Lettuce growing in greenhouses, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul. 1418*, pp. II+22, figs. 10).—A general discussion of greenhouse lettuce production, in which the author presents information on the scope of the industry, types of houses utilized, relation of lettuce to other forcing crops, soils, fertilizers, varieties and seed, planting, culture, yields, harvesting, and storage. In addition, there are incorporated chapters on diseases, by I. C. Jagger, and on insects, by W. H. White.

Report on survey of the canning tomato industry with suggestions for improvement, F. L. YAW (*California Sta. Circ. 280* (1924), pp. 30, figs. 12).—

As part of an investigational program conducted to discover the cause of diminishing tomato yields in California, the author presents the results of an extended survey of the tomato-growing industry in the San Francisco Bay region, outlining the present cultural practices, describing varieties commonly grown, and discussing diseases, which, apparently, are important factors in reducing yields. The so-called tomato blight is believed by the author to exist in two distinct forms, the western blight, the causal organism of which is still unknown, and Fusarium wilt, thought identical with the form causing injury in other tomato-growing sections. The characteristic symptoms which distinguish western from Fusarium blight are discussed in detail. Practical recommendations for the improvement of the tomato-growing industry are presented.

Station investigations on fruit-bud formation, J. W. WELLINGTON (*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas., 1922, pp. 89-93*).—This is a brief summary of the work of the agricultural experiment stations upon factors concerned in fruit-bud formation, including a list of 46 references.

How to store and germinate fruit seed (*New York State Sta. Bul. 509, pop. ed. (1924), pp. 4, fig. 1*).—A popular edition of the bulletin previously noted (*E. S. R.*, 52, p. 46).

[Winter hardiness of peaches and plums in Kentucky] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 37-39*).—Notes are given on the relative hardiness of different varieties of peaches and plums as affected by Kentucky conditions.

[Pruning studies at the Kentucky Station] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 36, 37*).—Records taken on the comparative amounts of bloom and set of fruit on heavily and lightly pruned young apple trees showed that heavy pruning not only retards the commencement of fruition, but also lessens the proportion of blossoms to set. Of 10 heavily pruned trees that bloomed abundantly, not one bore a heavy crop of fruit, while of 38 lightly pruned and full-blooming trees, 25 produced a full crop. Records show that 57 per cent of the lightly pruned trees bore some fruit, as compared with 33 per cent for the heavily pruned trees.

Varieties of tree fruits for Iowa planting, H. L. LANTZ (*Iowa Sta. Circ. 92 (1924), pp. 32, figs. 11*).—Because of the severe winters, which occasionally bring destruction to all but the hardiest fruit varieties, Iowa's pomology is necessarily restricted, most of the common commercial sorts of the Eastern and Pacific Coast States being too tender. Climatic and soil conditions divide the State into two fruit-growing regions, north and south, the northern area being adapted only to the very hardy varieties, such as Wealthy, Oldenburg, and Northwestern Greening apples. This paper is devoted largely to descriptions of apple, pear, plum, and cherry varieties which have proved their adaptability to Iowa, particular stress being laid on those sorts introduced by the station.

Twenty-five years of fertilizers in a New York apple orchard, U. P. HEDRICK and H. B. TUKEY (*New York State Sta. Bul. 516 (1924), pp. 3-28, fig. 1*).—In summing up the results of 25 years' study of fertilizers in an experimental Rome Beauty orchard on the station grounds, the authors again (*E. S. R.*, 42, p. 344) reach the conclusion that no form of fertilizer has had any significant effect on either the yield of fruit or the growth of the trees. No consistent differences were noted in the size, color, date of maturity, flavor, texture, or keeping quality of the fruit from the several treatments. Trunk diameters recorded in 1905, 1910, 1918, and 1923 show that the trees of the several plats have maintained their relative rank quite consistently throughout the entire

period despite fertilizer treatments. Furthermore, the rank of the plats in 1899, before any fertilizer had been applied, closely approximated the rank in 1923, after 24 years of liberal fertilization. The plats containing the largest trees have led in total production and in percentage of fruits 2.5 in. or above in diameter, indicating a close correlation between vegetative growth and production.

As a practical deduction from the experiment, the authors conclude that in the average well-cultivated, well-drained, and cover-cropped western New York apple orchard commercial fertilizers are not essential, but in order that the grower may ascertain the status of his orchard a simple fertilizer test is outlined. Tabulated data for the years 1919-1923 are appended.

Do fertilizers pay in New York apple orchards? (*New York State Sta. Bul. 516, pop. ed. (1924), pp. 4*).—A popular edition of the above.

Fruit setting in the J. H. Hale peach, V. R. GARDNER and S. JOHNSTON (*Michigan Sta. Quart. Bul., 7 (1924), No. 2, pp. 56-58*).—Following suggestions of Connors (E. S. R., 48, p. 837), pollen of the J. H. Hale, Banner, Elberta, Kalamazoo, and South Haven peaches was applied to emasculated and protected J. H. Hale pistils, with resulting sets of fruit of 0, 38.6, 35.8, 35.2, and 34.9 per cent, respectively, showing that, although J. H. Hale is completely self-sterile, satisfactory crops of this variety may be secured where cross-pollination with other varieties is insured. Of the four pollinizers used in the study, the South Haven is deemed most satisfactory, since its blooming period is practically coincident with that of the J. H. Hale. Emasculated Elberta flowers pollinated with Elberta pollen set 38.5 per cent of fruit, indicating that the sets obtained with the cross-pollinated J. H. Hale pistils were quite normal. The close relation of insect visitation and favorable weather to successful pollination of self-sterile fruits is emphasized.

The behavior of American grapes grafted on vigorous stocks, F. E. GLADWIN (*New York State Sta. Bul. 508 (1924), pp. 3-54, pls. 6, fig. 1*).—In continuing studies previously noted (E. S. R., 28, p. 640), a statistical analysis of data taken on the growth and productivity of Campbell, Catawba, Concord, Delaware, Iona, and Niagara vines grafted in the winter of 1914 upon Clinton, Riparia Gloire, and Rupestris St. George roots showed that the greater yields of fruit and cane from grafted plants were in most cases significant, as were also, for the most part, increases in trunk diameters. Computations of the average yields for the five years 1919-1923 show an average gain for Delaware on Gloire roots of 0.71 tons per acre above Delaware on its own roots. Campbell on Clinton and on Gloire gave respective average annual increases of 1.54 and 1.59 tons, gains found statistically significant for each of the five years for Clinton and in four of the five years for Gloire. Niagara averaged higher for the five years on all three stocks than it did on its own roots. The Concord, on the other hand, yielded quite as well on its own as on alien roots. In the case of Iona and Catawba, grafted plants were more fruitful than own-rooted plants. Furthermore, the quality of the fruit from grafted vines was recorded as markedly superior. In the case of Delaware, Campbell, Niagara, and Concord, grafting did not materially affect the time of foliation nor the date of the ripening of the fruit.

It is believed that grafted vines, because of their greater original cost, will, in spite of their superiority, be slow in coming into commercial use. For the ordinary home vineyard, however, grafted plants are deemed to be highly desirable.

Improving grapes by grafting (*New York State Sta. Bul. 508, pop. ed. (1924), pp. 4, figs. 2*).—A popular edition of the above.

FORESTRY

Tree habits: How to know the hardwoods, J. S. ILLICK (*Washington, D. C.: Amer. Nature Assoc., 1924, pp. V+337, pls. 64, figs. 56*).—Prepared in nontechnical language and profusely illustrated with cuts of trees, bark, leaves, flowers, and fruit, this book is designed to serve as a guide and identification of the trees native or now grown in the United States.

Shrubs of Indiana, C. C. DEAM (*Ind. Dept. Conserv. Pub. 44 (1924), pp. 351, figs. 148*).—In conformity with the Trees of Indiana, by the same author (*E. S. R., 45, p. 644*), the numerous shrubs and shrublike plants native or now naturalized in the State are described, accompanied in most cases by photographic illustrations and notes on their distribution and useful qualities. The section on willows (*Salicaceae*) was contributed by C. R. Ball of the U. S. D. A. Bureau of Plant Industry.

The national forests of Arizona (*U. S. Dept. Agr., Dept. Circ. 318 (1924), pp. 19, pl. 1, figs. 8*).—The nine national forests located in Arizona, covering an area of more than 12,000,000 acres and bearing an estimated stand of over 14,500,000,000 ft. of saw timber and 11,500,000 cords of wood, are discussed in detail in relation to their location, accessibility, lumber content, and value for grazing and for recreational purposes.

Trees and shrubs of Mexico (*Passifloraceae-Scrophulariaceae*), P. C. STANDLEY (*U. S. Natl. Mus., Contrib. U. S. Natl. Herbarium, 23 (1924), pt. 4, pp. 849-1312+XXXIX*).—This fourth installment of a catalogue of Mexican plants (*E. S. R., 49, p. 837*) deals with the families *Passifloraceae* to *Scrophulariaceae*.

Forestry in the Dutch East Indies, KEMPSKI (*Die Forstwirtschaft Niederländisch-Indiens. Berlin: Paul Parey, 1924, pp. 60, figs. 40*).—A brief report upon the forest resources and present forest activities, which to date have been almost entirely devoted to the teak (*Tectona grandis*), a species which is deemed by far the most important in this region.

Forestry in Brunei and Labuan, G. E. S. CUBITT (*Singapore: Govt., 1924, pp. 7*).—This is a brief statement prepared for the British Empire Forestry Conference, held in Canada in 1923.

Annual return of statistics relating to forest administration in British India for the year 1922-23 (*Brit. India Forest Admin. Statis., 1922-23, pp. [3]+31, pl. 1*).—The usual tabular and statistical data relating to forest surveys, forest production, expenditures, revenues, etc. (*E. S. R., 50, p. 344*).

Reafforestation with cedar (*Juniperus procera*), Shume Forest Reserve, Tanganyika Territory, E. D. MABER (*Quart. Jour. Forestry, 19 (1925), No. 1, pp. 6-12*).—A brief article dealing with some of the problems encountered in reforesting cedar upon the Shume Forest Reserve, where unusually slow natural reproduction necessitates the establishment of nurseries. The extended dry season, lasting for several months, necessitates the locating of nurseries near forest streams, where they may be watered and protected from insect and fungus pests. The shelterwood method has been found much more successful for the drier sites than open ground planting.

The French turpentine system applied to longleaf pine, E. R. McKEE (*U. S. Dept. Agr., Dept. Circ. 327 (1924), pp. 16, figs. 11*).—A comparative study of French and American methods of turpentine pine trees, carried on over a period of six years in the Florida National Forest, showed the French system to be the more satisfactory for second growth longleaf pine, yielding not only a higher production per acre but also a longer continued production without serious interference with the ultimate saw timber value of the

trees. Because of the narrowness and smooth edges of the French face, healing processes were relatively rapid. The results with older trees indicated that mature longleaf and slash pines may be most advantageously turpentine under the present American system, which permits profitable working for 14 years. The higher yields per acre resulting from the French system were due to the fact that a greater number of trees could be utilized and not to yield of individual faces, such being considerably less with the French system than with the American system.

Butternut produces "maple" syrup, P. A. HERBERT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 62, 63).—Two years' records of sap flow from butternut trees showed only 6 per cent less sap than from sugar maples of corresponding size. Analyses made by C. D. Ball, jr., showed butternut sap to contain 0.26 per cent of invert sugar and 2.10 per cent of sucrose, as compared with 0.11 and 2.61 per cent, respectively, for sugar maple. Butternut sirup was found to have the same maple flavor found in sugar maple sirup. However, the tree, because of the prevalence of the *Melanconis* disease, which materially shortens its life span, can in no sense take the place of maples as a source of sugar.

The quebracho forests of South America, G. A. KERR (*Washington: Pan Amer. Union*, 1924, pp. 27, figs. 13).—A general discussion based on personal notes and observations taken in Argentina and Paraguay upon the quebracho forests, the timber of which is highly prized as a source of tanning material. An earlier paper by the same author upon the same subject has been noted (*E. S. R.*, 45, p. 442).

The pulping qualities of fire-killed wood, E. P. CAMERON and W. C. LODGE (*Canada Dept. Int., Forestry Branch Bul.* 76 (1924), pp. 16, figs. 3).—Comparisons made at the Forest Products Laboratories of Canada of the pulps produced under identical cooking conditions from sound and fire-killed spruce and balsam fir woods indicated in a general way that a very fair product can be made from fire-killed wood, provided such is utilized before deterioration due to weathering and decay has progressed to any appreciable extent.

DISEASES OF PLANTS

Diseases of plants (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 69-75).—Results are given of experiments on the control, through breeding, seed treatment, etc., of leaf rust, stinking smut, and foot rot of wheat, and smuts of barley, oats, sorghum, and corn. Varying degrees of resistance were noted in the breeding experiments, and a large number of strains of cereals are under observation to determine their resistance or immunity from disease. For the control of the various smuts copper carbonate and some of the newer commercial preparations applied as dusts gave good results. Of the soaking methods tested none gave better results than the formaldehyde treatment.

Studies of the fungus organisms found in Kansas corn in 1923 showed that practically all Kansas seed corn carried *Fusarium moniliforme*, and that this was not confined to good or bad ears. No evidence appeared to indicate that this fungus is an important factor in reducing the yield of corn. *Gibberella saubinetii* was found to be a negligible factor in Kansas seed corn, and it did not enter into the root, stalk, or ear-rot problem in the State. *Diplodia zeae* varied in prevalence, but was more common in corn in Kansas in 1923 than ever before reported, and it is considered an important factor in injuring the germination qualities in seed corn.

Fruit and vegetable disease investigations have been continued, and the hot formaldehyde method of treating seed potatoes for the control of *Rhizoc-*

tonia was found the most efficient means of several tested. Solutions of corrosive sublimate were found to weaken rapidly when repeatedly used, especially when the tubers had been cut before treatment, while the formaldehyde solution retained its strength indefinitely.

The results of five years' experiments in spraying potatoes with Bordeaux mixture are said to have shown no increased crop production in the absence of early blight or tipburn.

Continued work on tomato wilt along lines of resistant varieties, studies of the organism in the laboratory, and studies of the cause of wilting are briefly reported upon. Evidence was obtained indicating that there are probably two physiological strains of *F. lycopersici* and that the actual wilting is probably due to an enzyme secreted by the organism.

Tests of the resistance of certain varieties of cabbage to yellows have been carried on for three years, and while the plants were resistant if grown in seed beds and transferred to the fields, the varieties sometimes proved susceptible if the seed were sown directly in the field. Studies carried over a considerable period have not shown that the organism causing yellows was distributed to any extent in the seed.

Experiments on the control of stem rot and black rot of the sweet potato have shown that by proper selection yields may be increased at least 100 per cent.

[Plant disease investigations] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 30-33*).—In continuation of investigations on tobacco diseases (E. S. R., 49, p. 544), a brief report is given of further testing of resistant strains of Burley tobacco to tobacco root rot. In connection with these investigations another important root disease of tobacco was observed where both the strain resistant to *Thielavia basicola* and local varieties produced a poor, uneven stand. When examined, the roots affected with this disease were found to be turning brown or occasionally reddish. Evidence was secured showing that possibly some local varieties are more resistant to this disease than others.

A brief account is given of bacterial leaf spot of tobacco, and attention is called to infection in the seed bed (E. S. R., 51, p. 353).

In connection with an investigation of mosaic disease of tobacco, it was demonstrated that the disease could overwinter in the bull nettle (*Solanum carolinense*) and in the ground cherry (*Physalis* sp.). An attempt was made to determine the extent to which the disease could be controlled by the elimination of these weeds from the plant bed. The weeds were found to develop taproots which sometimes extend to a depth of 28 in., and the only satisfactory method of eradication was by digging them out to the full length of the roots.

Studies of clover diseases are in progress at the station and on other soil types, particular attention being given to the root systems. During the spring of 1923 a plat of ground was steam sterilized and seeded to clover. A good stand was secured on both the sterilized and check plats, but the growth on the steamed plat was much more rapid than on the other. An examination of the root systems throughout the summer showed that those growing on the steamed soils were healthy and normal to a depth of 5 in., while those in the unsteamed soil showed rotted laterals and disease lesions. Late fall examinations showed the upper portions of the roots growing in the steamed plat to be somewhat diseased, but they were furnished with an abundance of small lateral roots, while all of the original smaller laterals on the plants grown in the unsteamed soils were dead.

Some studies on corn root rot are briefly reported, microscopic examinations having been made of the seeds, and it was ascertained that the fungus hyphae

are generally found as a loose network between the seed coat layers. No hyphae were found farther in the grain than the outer surface of the aleurone layer, and the area under the cap at the tip of the seed was not found to be infected. Field tests in previous years have shown that selection for so-called disease-free ears did not result in increasing yields over the badly diseased ones. In 1922 selections for rough and smooth ears resulted in slightly over 39 per cent more corn from the smooth ears than from the rough, while in 1923 the 50 smoothest ears yielded slightly over 13 per cent more than the 50 roughest ears selected from a lot of 700 good seed ears. Other studies are said to show that there is no evidence to indicate that any ears are free from infection.

Department of botany and bacteriology, D. B. SWINGLE (*Montana Sta. Rpt. 1923, pp. 25, 26, fig. 1*).—In order to test the effect of prolonged applications of arsenic on plant growth, various arsenicals were applied in the spring of the year to plats of ground, and the effect on crop production was noted. After seven years of such procedure beans and cucumbers made little growth, while wheat and timothy grew fairly well. No further applications of arsenic were made for six years, and at the end of that time it was found that very little of the arsenic had been removed by rains or irrigation. The author states that it has been found very difficult to get this land again into condition for cropping.

Suggestions are given for the control of blackleg of potatoes, a disease which is said to have been introduced into Montana about 1912. Investigations of the author have shown that seed potatoes after cutting may be treated for 5 minutes in a solution of formaldehyde, 0.5 pint to 15 gal. of water, or of corrosive sublimate, 2 oz. to 15 gal. of water, without injury to the tubers. Either of the treatments proved satisfactory in controlling the disease.

A brief report is given of barberry eradication work carried on in Montana in cooperation with the U. S. Department of Agriculture. It is claimed that most of the barberry bushes have been destroyed, and in 1922 there was little wheat rust in Montana, although weather conditions were suitable for an epidemic. In 1923 there was considerable rust in the central and eastern parts of the State, which is believed to have been associated with the rusted barberries that had been overlooked.

Germination of teliospores of rusts at Columbia, Missouri, W. E. MANEVAL (*Phytopathology, 12 (1922), No. 10, pp. 471-488*).—As a result of a study of the germination of teliospores of 10 species of rusts, the author found that the teliospores of certain rusts having a more or less definite rest period may germinate to some extent in December or earlier. Germination is said to be especially favored by prolonged floating on water and by alternate wetting and drying. As the season advanced a marked increase was observed in the percentage of spores germinating and a decrease in the time necessary for germination to begin, as well as for complete germination.

Staining germinating spores, W. H. DAVIS (*Phytopathology, 12 (1922), No. 10, pp. 492-494*).—Detailed directions are given for the germination, staining, and permanent mounting of spores of various fungi.

Seed-borne parasites—a general consideration of the problem, C. R. ORTON (*Science, 59 (1924), No. 1538, pp. 539-546*).—This is an address delivered before the Canadian Branch of the American Phytopathological Society on December 20, 1923, in which the author reviewed the nature and importance of seed-borne parasites, their dissemination, means that have been adopted for their control, and the need for further research on diseases of this character and of cooperation and coordination of effort to prevent their further spread.

An ascigerous stage and synonymy for *Fusarium moniliforme*, G. O. WINELAND (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9 pp. 909-922, pls. 2, figs. 6).—From a study of cultures of strains of *F. moniliforme* the author reports an ascigerous stage of the fungus, which is technically described under the name *Gibberella moniliformis* n. comb. The synonymy of the fungus is discussed at length.

Morphological differences between *Nectria galligena* and *N. coccinea*, S. M. ZELLER (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 442).—Morphological differences in the above species of *Nectria* as they occur in Oregon are described.

Notes on *Synchytrium*, J. McMURPHY (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 442).—The author reports *S. papillatum* on *Erodium moschatum*, and a second species of *Synchytrium* on three species of *Hosackia*.

Septoria diseases of cereals and certain grasses, G. F. WEBER (*Phytopathology*, 12 (1922), Nos. 10, pp. 449-470, pls. 2, figs. 5; 12, pp. 537-585, pls. 4, figs. 16; 13 (1923), No. 1, pp. 1-23, figs. 9).—Descriptions are given of speckled blotch of oats caused by *Leptosphaeria avenaria* n. sp.; glume blotch of wheat due to *S. nodorum*; speckled leaf blotch of wheat, *S. tritici*; leaf blotch of rye, *S. secalis*; leaf blotch of barley, *S. passerinii*; leaf blotch of quack grass, *S. agropyri*; leaf blotch of brome grass, *S. bromi*; and leaf spot of Kentucky blue grass due to a species of *Septoria* closely resembling *S. graminis*.

Bacterial blight of rye, C. S. REDDY, J. GODKIN, and A. G. JOHNSON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 10, pp. 1039, 1040, pl. 1).—A report is given of a study of the bacterial disease of rye observed near Bloomington, Ill., in 1921, and investigated in 1921 and 1922 in comparison with a bacterial disease of barley due to *Bacterium translucens* (E. S. R., 38, p. 548) and black chaff of wheat caused by *B. translucens undulosum* (E. S. R., 41, p. 246). On the basis of the authors' studies it is considered that the new rye organism differs from the above organisms only in degree of pathogenicity. The cause of the disease on rye is described as *B. translucens secalis* n. var.

Seed treatment to prevent smuts of wheat, R. C. THOMAS (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7-8 pp. 117, 118).—Popular directions are given for seed treatment for the prevention of smut, the hot water treatment being recommended for the control of loose smut and formaldehyde or copper carbonate for stinking smut.

Yeast-spot of Lima beans, S. A. WINGARD (*Phytopathology*, 12 (1922), No. 11, pp. 525-532, figs. 4).—A yeast spot of Lima beans and cowpeas caused by *Nematospora phaseoli* n. sp. is described. The disease appears to be restricted to the seed, on which it forms dark brown sunken areas. Specimens of the disease have been collected in seven counties in eastern and central Virginia.

The bacterial pathogen of corn stalk rot, H. R. ROSEN (*Phytopathology*, 12 (1922), No. 10, pp. 497, 499).—In a previous publication (E. S. R., 47, p. 243) the author gave an account of bacterial root and stalk rot of corn that had appeared in Arkansas, without identifying the organism. Subsequent investigations have shown that the disease is much more widely spread, and a preliminary description is given of the pathogen, which is named *Pseudomonas dissolvens* n. sp.

Non-inheritance of terminal bud abortion in Pima cotton, T. H. KEARNEY (*Jour. Agr. Research* [U. S.], 28 (1924), No. 10, pp. 1041, 1042, pl. 1).—The author reports a frequent occurrence of abortion of the terminal bud in plants of Pima-Egyptian cotton, 4 per cent of a lot of plants under observation in 1918 being so affected. On growing normal and aborted individuals, a study of the progeny indicated that abortion of the terminal bud in this case is not an inherited character.

The bacterial spot of pepper, B. B. HIGGINS (*Phytopathology*, 12 (1922), No. 11, pp. 501-516, pls. 2, figs. 5).—A detailed description is given of a bacterial spot of peppers, the occurrence of which in Georgia has been previously reported (E. S. R., 49, p. 346). The disease is said to be caused by a species of *Bacterium* very similar to *B. vesicatorium* and *B. exitialis*, but it differs from these forms in some important physiological reactions. Seed treatment with a 1:1,000 solution of corrosive sublimate proved effective in controlling the disease.

The effect of presprinkling with water upon the efficiency of certain potato seed treatments for the control of Rhizoctonia, J. M. RAEDER and C. W. HUNGERFORD (*Abstr. in Phytopathology*, 12 (1922), No. 9, pp. 447, 448).—The authors claim that laboratory tests have shown that the efficiency of both the corrosive sublimate and hot formaldehyde treatments for seed potatoes is greatly increased by first sprinkling the potatoes with water and covering them for 24 or 48 hours.

Snails as predisposing agents of sugar cane "root disease" in Louisiana, R. D. RANDS (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 9, pp. 969, 970).—From a study of a large number of incipient cases of root injury, the author reports that a small snail (*Zonitoides arboreus*) may be primarily responsible for the trouble. Root pitting by the above snail was observed both by direct field observations and by feeding tests with isolated snails in the laboratory. Severe root injury and the same species of snail were also found in the peaty soils of southern Florida, while in the light sandy soils of northern Florida and Georgia but slight injury was observed.

The author believes that severe root injury by snails is apparently a major predisposing and contributing factor to the final complex condition known as root disease.

[Soil sterilization for vegetables] (*Kansas Sta. Bien. Rpt. 1923-24*, p. 67).—An investigation is briefly reported upon, in which nematodes attacking cucurbits and solanaceous plants in greenhouses were apparently successfully controlled by soil sterilization. Cucumbers were protected against anthracnose by spraying with Bordeaux mixture.

A new host for the fire blight organism, *Bacillus amylovorus*, L. M. SNOW (*Phytopathology*, 12 (1922), No. 11, pp. 517-524).—In addition to the previously known host plants of the fire blight organism (*B. amylovorus*), the author reports its occurrence on an ornamental shrub (*Prunus triloba plena*). The morphology and culture reactions of the organisms on this host are described.

[Control of fire blight on apples] (*Kansas Sta. Bien. Rpt. 1923-24*, pp. 62-66).—An account is given of an experiment for the control of fire blight, in which the infected twigs and spurs were cut out, the wounds being disinfected. This procedure was continued at frequent intervals until in August. A study was made of the orchard on August 10, which showed that the number of twig and stem lesions had been very materially reduced. It is claimed that hold-over cankers on all pear and apple trees in the entire neighborhood must be eradicated in order to secure immunity from blight, and it is believed that insect control, especially that of the aphids, would greatly lessen the spread of the bacteria.

Bitter pit in apples: The crushed cell theory, D. A. HERBERT (*Phytopathology*, 12 (1922), No. 10, pp. 489-491).—The author is not in agreement with McAlpine regarding the cause of bitter pit in apples (E. S. R., 38, p. 352), and he maintains that the bursting cell theory does not satisfactorily explain the ultimate cause of bitter pit. He claims that the affected cells have been

killed by being crushed by neighboring cells having higher osmotic pressure due to their higher proportion of sugar. The presence of starch in quantity in the pit cells, the intact skin over the pitted areas, the first external symptoms being a sinking of the skin, and the fact that a vascular bundle may run through a pit area and supply healthy tissue beyond are said to support his view.

Expulsion of aecidiospores by the Mayapple rust, *Puccinia podophylli*, B. O. DODGE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9, pp. 923-926, pl. 1, fig. 1).—As a result of a study of the aecidiospores of the common rust of May apples, the author claims that the germ pores of the aecidiospores of this rust are developed as the result of localized thickenings of the wall in such a way that little plugs are formed, and that these become separated from the rest of the wall. The plugs, deeply indenting the elastic walls, serve as fulcrums against which the walls react as the spore is set free, so that it is discharged with considerable violence.

No indication was found of an increased development of stomata on the leaves of *Podophyllum* infected with *Puccinia podophylli*.

Orchard injury from waterlogged soils, E. BURKE (*Montana Sta. Rpt.* 1923, p. 27, fig. 1).—As a result of a study of certain orchard lands in the Bitter Root Valley, considerable damage was found, due to a temporary water-logged condition of the soil. Cutting off the excessive water supply to the trees very much improved their condition during 1923. Some of the trees in the orchard appeared to be suffering from a lack of available iron salts, and an injection of ferrous sulfate into the trunks is said to have brought about a normal development of the leaves.

[Orchard disease investigations in Kansas] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 58, 59).—A report is given of spraying experiments for the control of apple scab on Winesap trees, comparison being made of dry lime sulfur and liquid lime sulfur. On account of the failure of the apple crop no study was made of apple scab control on the fruits, but the leaves of the sprayed plats were practically free from scab, while the check plats had an average of nearly 60 lesions per leaf. No significant difference was observed due to the different fungicides.

An attempt was made to control apple rust by spraying with lime sulfur, but without satisfactory results. During the winter of 1923-24 all the red cedar trees on the horticulture farm were inspected for the overwintering cedar apples, which were removed. After the spring rains started in April the cedar trees were again inspected, and such treatment, although rather expensive, materially reduced the amount of apple rust infection.

A dormant spray of commercial lime sulfur 1:15, applied to the station peach orchard the last week in March, gave perfect control of peach leaf curl. Applications of Bordeaux mixture, 3-4-50, sprayed on trees at 2-week intervals after the fall of the petals, gave excellent control of cherry leaf spot in the station orchard.

The fungus causing the common brown rot of fruits in America, J. W. ROBERTS and J. C. DUNEGAN (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9, pp. 955-960, pls. 2).—On account of the confusion of names assigned to the fungus which causes the brown rot of stone fruits in America, the authors have made a study of the literature and have made cultures of type material, which lead them to believe that it is more logical and practicable to consider the American form and the European form as a single species having the name *Sclerotinia cinerea*. Of the various names that have been suggested for this fungus, the

authors claim that *S. fructigena* can not be applied to the American species as that name belongs to an European species quite distinct from the American one. The adoption of the name *S. fruticola*, which has priority in publication, is not considered advisable under present conditions.

Peach diseases, H. C. YOUNG and L. R. HESLER (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7-8, pp. 131-136).—A popular account is given of some of the more common diseases occurring on the peach in Ohio, with suggestions for their control.

Uninucleated aecidiospores in *Caeoma nitens* and associated phenomena, B. O. DODGE (*Jour. Agr. Research* [U. S.], 28 (1924), No. 10, pp. 1045-1058, pls. 5).—In continuation of his studies of the orange rust of blackberry (E. S. R., 50, pp. 353, 354) the author gives the results of germination tests of a considerable series of spores from infected leaves from which he concludes that spermogonia are always found in large numbers on leaves of *Rubus* infected with the long-cycle orange rust *Gymnoconia interstitialis*. If no spermogonia are present on a leaf showing aecidia of orange rust the spores will be found to be uninucleated, and on germination they will form 2-celled promycelia. In strains of the short-cycle rust whose spores develop 4-celled promycelia, spermogonia always precede or accompany the formation of aecidia.

Certain strains of the short-cycle orange rust on *Rubus* are said to not develop spermogonia except, perhaps, as they are aborted or vestigial. The aecidiospores in such strains are for the most part uninucleated. So far as yet observed spermogonia are always matured by the long-cycle rust, and cell fusions occur. Strains of the rust which commonly form 4-celled promycelia when the aecidiospores are germinated always develop spermogonia. In this form the binucleated aecidiospores arise as the result of cell fusions.

Fig smut studies, E. H. SMITH and E. H. PHILLIPS (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 442).—A report is given of an investigation of fig smut in California, the study being confined to the infection of white varieties of fig fruit by *Aspergillus niger*.

Preliminary results with the borax treatment of citrus fruits for the prevention of blue mold rot, H. R. FULTON and J. J. BOWMAN (*Jour. Agr. Research* [U. S.], 28 (1924), No. 9, pp. 961-968, figs. 5).—The authors report that preliminary tests have shown that commercial borax solution in a strength of 5 or 10 per cent applied to the surface of oranges or lemons and allowed to dry greatly reduced blue-mold rot under conditions that are unusually favorable for rot development. Oranges and grapefruit handled in a commercial way, when treated with the borax solution, showed a marked reduction of both *Phomopsis* and *Diplodia* types of stem-end rot, as well as of the blue-mold rot. The borax treatment is considered promising, in connection with careful handling of fruit, in reducing losses from blue-mold rot.

White pine blister rust in the Pacific Northwest, J. S. BOYCE (*Abs. in Phytopathology*, 12 (1922), No. 9, p. 448).—White pine blister rust (*Cronartium ribicola*) was first reported in the Pacific Northwest in the fall of 1921. In British Columbia the English black currant was found infected, and a few diseased trees of the eastern white pine and the Himalayan pine were observed. In Washington black currants were found infected in several localities, and two eastern white pines, killed by the parasite, were collected in the nursery at Mount Vernon.

In the spring of 1922 infection of the western white pine (*Pinus monticola*) in western British Columbia was found to be quite general. The author states that there is as yet no indication of the disease in the commercial white pine region of Idaho or western British Columbia, or in the sugar pine stands of southern Oregon and British Columbia.

Note concerning the decay of western yellow pine slash caused by *Polyporus volvatus*, H. SCHMITZ (*Phytopathology*, 12 (1922), No. 10, pp. 494-496, fig. 1).—The author reports the general occurrence of *P. volvatus* on western yellow pine slash, and ventures the opinion that this fungus may be of greater importance than is generally supposed.

A fungus destructive to asphalt shingles, F. L. STEVENS (*Phytopathology*, 12 (1922), No. 10, pp. 497, 498, fig. 1).—The destruction of asphalt shingles by a fungus mycelium, the character of which resembles that of *Merulius lachrymans*, is reported.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Directory of officials and organizations concerned with the protection of birds and game, 1924, compiled by G. A. LAWYER and T. DENMEAD (*U. S. Dept. Agr., Dept. Circ. 328* (1924), pp. 16).—This is the twenty-fifth annual directory (*E. S. R.*, 50, p. 355).

Individual and age variation in *Microtus montanus yosemite*, A. B. HOWELL (*Jour. Agr. Research* [*U. S.*], 28 (1924), No. 10, pp. 977-1016, pl. 1, figs. 25).—This is a report of a detailed study made in Mono County, Calif., during July, 1922, of the individual and age variation occurring in the common meadow mouse *M. montanus yosemite* Grll.

Injurious insects and other pests [and bees] (*Kansas Sta. Bien. Rpt. 1923-24*, pp. 76-87, 119, 120).—Investigations have shown that at temperatures slightly below their optimum, or from 55 to 65° F., the pea aphid lives longer, reproduces more rapidly, and produces more young on alfalfa than on peas, while at temperatures slightly above the optimum (80 to 90°) the aphid is more successful on garden peas than on alfalfa. At Manhattan the pea aphid most commonly overwinters on alfalfa as wingless agamic females, which reproduce in the spring even at low temperatures, reaching damaging numbers before their predators become active and being injurious to alfalfa from March to May. Their dissemination takes place during May and June, and during July and August they may be entirely absent from alfalfa, though they do occur on peas during that time. They return to alfalfa in September, their behavior being greatly influenced or controlled by weather conditions.

The clover sitones (*Sitones linellus*), clover-leaf weevil, alfalfa plusia (*Plusia simplex*), and alfalfa caterpillar were reared under controlled conditions for one generation. A study was made of the wilt disease, which, at Manhattan, plays an important part in the control of the alfalfa caterpillar. Observations of the life history of the Hessian fly were continued (*E. S. R.*, 49, p. 453; 50, p. 54). Studies were also made of the corn earworm (*E. S. R.*, 51, p. 361) and other insects injurious to corn. Cooperative experiments were conducted on truck farms in the control of melon insects. Work was done on insects attacking the sorghums, insects attacking roots of staple crops, insects injurious to alfalfa (*E. S. R.*, 51, p. 362), and shade tree insects. Control work with rodents was also conducted.

In bee investigations, an article upon which by Merrill is noted on page 459, it was found that the peak of brood rearing in Kansas usually comes about the first week in May, and that there may be a second peak of brood rearing in those colonies which are plentifully supplied with food, if similar weather conditions again occur before the honey flow begins. There was found to be an inverse correlation between the rate of brood rearing and the nectar flow.

[Economic insects in Kentucky] (*Kentucky Sta. Rpt. 1923*, pt. 1, pp. 35, 36, 37).—The cotton worm appeared late in the season and did a great deal of

injury to cotton grown in Christian and several other counties in southwestern Kentucky. In the fall the moth appeared about ripening fruit in immense numbers and was charged with destroying grapes, peaches, apples, and the everbearing strawberries, although tests indicate that it is unable to break the sound skin of these fruits. It was found in some preliminary tests that the harlequin bug, which was the source of injury to crucifers, can be destroyed by 2 per cent nicotine dust, freshly prepared. The apple bud-worm (*Haploa lecontei*), a circular relating to which has been previously noted (E. S. R., 46, p. 157), was found to hibernate among rubbish on the ground, and Tanglefoot will protect trees from it completely.

[Report of the the Montana Station] entomology department, R. A. COOLEY (*Montana Sta. Rpt. 1923, pp. 29-31*).—The increase and wide distribution of the pale western cutworm (*Porosagrotis orthogonia* Morr.) over the State during the drought period of 1917-1919 is offered as a striking illustration of the effect of weather on multiplication of insects. This insect, which previously had not been considered a serious pest, destroyed many thousands of acres of crops. With the return of the moister seasons it practically disappeared from the State, except for a small area in the northern part of Liberty County. Recent outbreaks in Colorado and New Mexico are said to have strengthened the theory of its climatic limitations, and to confirm its distribution as mapped by the author. These continued observations are said to give a basis for predicting possible future outbreaks. The rainfall during May, June, and July of the year preceding the outbreak seems to be the determining factor. If the rainfall is less than 4 in. for these months the insect will very likely be found in increased numbers the next year, while if the rainfall is more than 5 in. a decrease will be found the following year.

It is pointed out that certain heavy-body miscible oils, applied before the fruit buds are open in the spring, control the fruit-tree leaf-roller by destroying the eggs. In 1921 parasites reduced the infestation of leaf-rollers by about 10 per cent, and in 1922 by 27 per cent, while in 1923 68.8 per cent of the pupae were parasitized. In 1922 other natural agencies destroyed 39 per cent and in 1923 20 per cent. The increasing effectiveness of natural enemies, which reached a total of 90 per cent in 1923, indicates that in the near future the pest will cease to be abundant and injurious in the Bitter Root Valley.

It is pointed out that in western Montana kerosene emulsion is of no value in controlling the oyster-shell scale, but that lime sulfur solution or miscible oils applied just before the leaf buds open will generally control it. Lime sulfur solution is said to be the most effective remedy for the control of apple scab, as well as for the oyster-shell scale.

Economic entomology in Porto Rico [trans. title], G. N. WOLCOTT, trans. by F. SEÍN, JR. (*Porto Rico Dept. Agr. and Labor Sta. Bul. 32 (1924), Spanish ed., pp. 176, figs. 168*).—This is a general account of insects of economic importance in Porto Rico arranged according to the crops, etc., attacked.

[Notes on economic insects] (*Jour. Econ. Ent., 17 (1924), No. 5, pp. 601-606*).—The larva of *Recurvaria nanella* Hübn. is recorded by T. L. Guyton and A. B. Champlain as having caused considerable damage to the young leaves of peach, quince, sweet cherry, and plum at Harrisburg, Pa. In some instances as high as 50 per cent of the terminals were infested.

Larvae of the painted lady butterfly (*Pyrameis cardui* L.) are reported by C. R. Cutright, of the Ohio Experiment Station, to have caused the destruction of Canada thistles in northcentral and northwestern Ohio, in some sections their abundance being so great that an uninfested plant could not be found. The leaves, blossoms, and upper part of the stem were usually entirely destroyed.

The adults of *Strategus antaeus* are reported by S. Marcovitch, of the Tennessee Experiment Station, to have been found the last week in June burrowing underground and girdling 1- and 2-year-old peach trees in the vicinity of Harri-man, Tenn. The first record of the occurrence of the cornroot worm in Connecticut, where it was observed in August, 1923, is made by W. E. Britton.

A European leaf miner of birch, *Fenusa pumila* (Klug), is reported by Britton as having appeared in several localities in Connecticut in 1923, this being the first record of its occurrence in the United States. Its quite general occurrence in eastern New York State was also observed by E. P. Felt.

A spittle insect, *Lepyronia quadrangularis*, is reported by W. J. Baerg, of the Arkansas Experiment Station, to have caused noticeable injury to corn in Carroll County, Ark. Successful use of calcium cyanide in the destruction of *Vespa infernalis*, which infested a house at Fort Collins, Colo., is reported by G. S. Langford. A species of the genus *Prospaltella* was observed by S. E. Flanders during June and July, 1924, parasitizing about 3 per cent of the eggs of the codling moth on English walnuts in Ventura County, Calif.

A wireworm of the genus *Melanotus* is reported by W. E. Anderson and T. E. Holloway as having destroyed sugar cane on a plantation near Morgan City, La. About 250 acres of stubble cane was found to have been completely destroyed, together with about 50 acres of plant cane.

The removal of several first-stage larvae of *Wohlfartia vigil* Wlk. from the conjunctiva of a man in Cattaraugus County, N. Y., is reported by Felt.

The Argentine ant is reported by M. R. Smith to have been apparently successfully eradicated from one and one-half blocks at Fayette, Miss., during the summers of 1922 and 1923. It is thought to be the first successful eradication of this pest in the United States.

Notes on the winter mortality of three coccids, *Pseudaonidia duplex* (Ckll.), *Chrysomphalus aonidum* (L.), and *C. dictyospermi* Morg., at New Orleans, are presented by T. F. Catchings and W. D. Whitecomb.

The control of insects in cereal food products, R. W. DOANE (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 549-553).—In an attempt to find the source of infestation of prepared breakfast cereals, corn meal, etc., studies were made of the packages in which the cereals are packed and of the sterilizers at some of the mills, and it was found that frequently the sterilization process is not sufficient to destroy all of the insects. At other times the cereal was found to be subjected to a reinfestation after it had been sterilized. A table showing various temperatures at which insects will be killed is given, as well as a description of a sterilizing apparatus devised by the author with which electric heat is used to sterilize the cereal with an exposure of approximately two seconds.

A taxonomic and ecological study of the species of the subfamily Oedipodinae (Orthoptera-Acrididae) found in Utah, with a summary of world distribution and a list of Orthoptera recorded for the State, W. W. HENDERSON (*Utah Sta. Bul.* 191 (1924), pp. 150, figs. 18).—A synopsis of grasshoppers of the subfamily Oedipodinae occurring in Utah (pp. 11-123) is followed by a tabulation of the geographical distribution of the Oedipodinae of the world (pp. 124-126), a list of recorded Orthoptera of Utah, 131 in number (pp. 127-133), a list of the literature cited in the text or used in the preparation of it (pp. 134-139), and a glossary of terms used in describing species (pp. 140-143).

The so-called cotton flea, W. D. HUNTER (*Jour. Econ. Ent.*, 17 (1924), No. 5, p. 604).—A new and severe form of injury to cotton, which has attracted attention principally in southern Texas in 1923 and 1924, is thought to be due to the caspid *Psallus seriatus* Reut., through its transmission of a virus that brings about profound changes in the habit of growth of the plant entirely out of pro-

portion to the number of insects that have been found in the field. The very young squares are blasted, the number of fruiting branches is reduced, and the main stem of the plant grows excessively tall. During 1923 the loss from this cause in south Texas was much greater than from the boll weevil, no crop whatever having been produced in hundreds of fields. In 1924 the injury was much less, but still very considerable in Calhoun and neighboring counties on the coast of Texas. In one field examined in July, 1924, only 765 bolls were found on 1,000 plants. What appears to be the same form of injury was reported in July, 1924, in Georgia and South Carolina.

The citrophilus mealybug, *Pseudococcus gahani* Green, as a major pest of citrus in southern California, H. M. ARMITAGE (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 554-561).—This is a review of the citrophilus mealybug situation in California. The ladybird beetle *Cryptolaemus montrouzieri* Muls., an introduced predator, is particularly effective, and is being liberated monthly by eight county and association insectaries to the extent of half a million beetles.

Comparative efficiency of dust and spray mixtures in controlling the currant aphid, P. J. PARROTT and S. W. HARMAN (*New York State Sta. Bul.* 517 (1924), pp. 4-21, pls. 4, fig. 1).—This is a report of experiments conducted with a view to determining the comparative efficiency of a number of preparations, in liquid and dust form containing nicotine as the principal insecticidal agent, for combating the current aphid, a common pest of currants in New York State. In these experiments, the details of which are presented largely in tabular form, nicotine sulfate (40 per cent nicotine) was used in a spray mixture at the rate of 1 pint to 100 gal. of water, to which 5 lbs. of dissolved soap were added. It was employed in several dust mixtures to give a nicotine content of approximately 0.5, 1, and 2 per cent, respectively, sulfur lead arsenate serving as the carrier. Tobacco dusts containing 1 and 3.5 per cent, respectively, of nicotine were also tested, the 1 per cent strength being applied undiluted as well as in combination with lime hydrate.

The aphid displayed marked susceptibility to thorough applications of the different preparations. While certain preparations manifested a more rapid rate of toxicity or were somewhat more effective than others, the difference in insecticidal efficiency was not marked, leading to the conclusion that, so far as the currant aphid is concerned, thorough and timely applications of the different materials tested had afforded noticeable protection. Whereas the average infestation of untreated patches was 27.16 per cent in 1922 and 26.30 in 1923, the treated plats showed an average infestation of from 0.06 as the minimum to 4.4 per cent as the maximum. It required two or three applications of either spray or dust mixtures to insure almost complete freedom of foliage injury during severe outbreaks of the aphid.

"The first treatment was made when the terminal leaves that first appeared after the breaking of the buds had a diameter of about 0.5 to 1 in. in order to destroy the newly hatched nymphs of the first generation. The destruction of these insects protected the blossom and fruit clusters, preventing the curling and other distortions of the leaves as well as reddish discoloration of the foliage. The control of the aphids of the first brood simplified the work of the later treatments, since the insects were forced to occupy relatively exposed positions on the new growth, where they were quite accessible to treatment. The second application was given just after blossoming, while the third treatment was applied about one month before harvesting the crop."

The Lepidoptera of New York and neighboring States: Primitive forms—Microlepidoptera, pyraloids, bombyces, W. T. M. FORBES (*New York Cornell*

Sta. Mem. 68 (1923), pp. 729, figs. 439).—This work, dealing with 43 families of microlepidopterans, pyralids, and bombycids, has been prepared with a view to facilitating the recognition of the Lepidoptera of the State and to assembling the known data on the life histories, whether published or in the form of notes associated with the various collections. It is pointed out that while the work is, in a sense, a compilation, it is largely of matter never before published; that the keys, in particular, are for the most part a new venture, since for many groups of American Lepidoptera none have ever before been worked out, and even the published keys to European forms need revision. The present work includes about half, comprising the more primitive forms, of the Lepidoptera. The work on Nepticulidae (pp. 79–98) and on the genera *Cremastobombycia* and *Lithocolletis* of Gracilariidae (pp. 185–202) is by A. F. Braun, and that on Coleophoridae by C. Heinrich (pp. 202–217). A food index (pp. 693–702) and a name index (pp. 703–729) are included.

Life history of the codling moth in the Yakima Valley of Washington, E. J. NEWCOMER and W. D. WHITCOMB (*U. S. Dept. Agr. Bul.* 1235 (1924), pp. 77, pls. 3, figs. 35).—The losses from wormy apples during the years 1915 to 1918, in the region about Yakima, where previously little difficulty had been experienced in controlling the pest, led to an investigation during the years 1919 to 1921 the details of which are presented in tabular and chart form. Notes on the life history in the Wenatchee Valley, Wash., are also included.

The climatic conditions were found to be such that two practically complete generations occur, with a very small third generation in some seasons. It was found that “a winter temperature of -25° F. or colder may kill all the codling-moth larvae above snow line, a temperature of -20 to -25° may kill 80 to 90 per cent of the larvae, a temperature of -15 to -20° may kill 70 to 80 per cent, while a temperature of only -7 or -8° kills only about 4 per cent of the wintering larvae. . . . From 75 to 85 per cent of the first brood of larvae and from less than 1 per cent to nearly 2 per cent of the second brood of larvae transform the same season, the others waiting until the following year.

“The egg parasite *Trichogramma minutum* Ril. has been observed in the Yakima Valley, and the larval parasites *Aenoplex plesiotypus* Cush. and *Epiurus indagator* Walsh were observed at Wenatchee. Occasional evidence of predators was observed.”

Migration—an important habit of the European corn borer, G. W. BARBER (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 582–589, pl. 1, figs. 2).—This paper deals with the migratory habits of the European corn borer in the heavily infested area of Massachusetts. Evidence obtained from a study of the insect in the field is presented, showing that the larvae sometimes migrate in large numbers, particularly from overpopulated cornstalks. It is shown that this movement is greatest on the warm nights of late summer. Overwintering of larvae in locations other than the host plant is discussed.

Hessian fly, wheat insect survey, 1924, R. FAXON (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7–8, pp. 124–127, fig. 1).—This survey, conducted in continuation of those made annually since 1918 (E. S. R., 51, p. 453), covered 33 counties distributed over the main wheat-growing sections of the State. For Ohio as a whole the infestation has increased from an average of 4.3 per cent for 33 counties in 1923 to an average of 10.3 per cent for the same number of counties in 1924.

The biology and control of the chrysanthemum midge (*Diarthronomyia hypogaea* F. Low), C. C. HAMILTON (*Maryland Sta. Bul.* 269 (1924), pp. 13–51, figs. 10).—This is a report of investigations of the chrysanthemum gall-midge, conducted in 1921 and 1922.

The incubation of the egg was found to require from 4 to 12 days, with most of the eggs hatching on the fifth and sixth days. The larval stage varies from 2 weeks to several months, normally not more than 4 weeks. The longer periods of the larval stage occur during aestivation and during the more or less dormant period in winter. The pupal stage varies from 6 or 7 days to several months, with an average of from 10 to 15 days. The adults live from 0.5 to 2 days. The life cycle varied from 29 to 65 days. The author's observations indicate that the number of generations annually vary normally between six and eight. It is stated that in protected places the midge has been observed to live over the winter and increase in the spring on outdoor plants.

Two ants, *Aphaenogaster fulga aquia* Bucky. and the pavement ant, appear to be important enemies through their opening the galls and removing the larvae and pupae, as high as 50 per cent having been observed in June and July to have been opened. The chalcid parasite *Tetrastichus diarthronomyiae* Gah. was found in five of nine greenhouses examined, the parasitism ranging as high as 54 per cent, with an average of 19 per cent.

Experimental control work, the details of which are presented in tabular form, has shown that the midge can be controlled efficiently either in the adult or egg stages. It is the author's belief that, by following the recommendations here advocated, the insect can be entirely eradicated from individual houses, or so controlled that the injury is reduced to a negligible amount. Control is best accomplished in the winter or very early spring, through directing the efforts toward obtaining clean cuttings from the stock plants, which should be grouped together in one greenhouse where the control measures will be effective on the largest number of plants in the least possible time. Under the average greenhouse conditions, it seems that control can be most effectively produced by spraying with either 40 per cent nicotine sulfate or free nicotine used at a dilution of 1 to 500 parts of water. It is desirable to use a spreader in the diluted spray material. A casein-lime spreader used at the rate of one rounded tablespoonful to each 2 gal., or a noncaustic soap used at the rate of 1 oz. to each 2 gal., will give good results. The spraying should be done at intervals of not longer than 4 days apart, preferably twice a week on definite days, one 3 and the other 4 days apart. Fair control results were obtained by using Kilspray, an extract of pyrethrum, diluted 1 to 500 parts of water, plus 1 oz. of soap to each 2 gal.

"The control can be most easily effected by spraying, if the tips of all new growth on the stock plants are cut off and spraying started from 4 to 5 weeks before time to start taking cuttings for rooting. If the spraying is well done and cuttings are taken only from the new growth, they will be free from midge infestation. All cuttings and young potted plants should be rooted and kept in a greenhouse entirely separated from the ones where the stock plants are grown. The cuttings should be dipped in a solution of the spray material before putting them into the rooting beds. The cuttings and young potted plants can not be sprayed thoroughly enough to control the midge without danger of injury. While in the rooting beds the cuttings should be examined at least once a week and any developing galls removed. Plants moderately or severely infested should be removed and destroyed in order to prevent reinfestation. The plant remains from all infested beds should be burned."

A systematic study of the Anthomyiinae of New York, with especial reference to the male and female genitalia, H. C. HUCKETT (*New York Cornell Sta. Mem.* 77 (1924), pp. 3-91, pls. 18, fig. 1).—This report of a study of the Anthomyiinae of New York includes a key to the genera, synonymies,

records, descriptions, and keys to the species, of which 92 have been identified from New York. Descriptions are given of 13 new species, and several species are redescribed. The morphology of the genitalia is considered at some length, and a 9-page list is given of references to the literature.

The Japanese beetle, R. H. PETTIT (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 58, 59, fig. 1).—This is a brief account calling attention to the Japanese beetle and the importance of its early detection when it invades the State.

Life history and biology of *Echocerus cornutus* (Fab.), D. SHEPHERD (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 572-577).—The author presents a description of the various stages, together with notes on the life history and food habits of *E. cornutus*, a cosmopolitan bran beetle which injures cereal products in the coast and bay regions of California.

Determination of temperatures fatal to the powder-post beetle, *Lyctus planicollis* LeConte, by steaming infested ash and oak lumber in a kiln, T. E. SNYDER and R. A. ST. GEORGE (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 10, pp. 1033-1038, pl. 1).—This is an account of a series of cooperative experiments conducted in November and December, 1923, and in January, 1924, at the navy yard, League Island, Philadelphia. The experiments showed that "temperatures below 130° F. are not fatal to the powder-post beetle *L. planicollis* when the temperature of infested ash and oak lumber is raised to these temperatures in a kiln by the use of live steam and are held there for only one-half hour, if all parts of the wood have not previously been brought to kiln-drying temperature. Temperatures of 130° and upward, maintained for one and one-half hours, or longer, are fatal to these insects if all parts of the wood infested by them have at the beginning of the exposure to these temperatures been brought to the minimum temperature of 130°. The standard kiln-drying schedule for ash and oak, to be used for aircraft stock in a kiln operated by live steam, will prove fatal to the powder-post beetle, and will check all damage that is being done in any infested material."

***Cylindrocopturus jatrophae* Fall, a new economic insect, C. T. VORHIES** (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 526, 527).—The curculionid *C. jatrophae*, first discovered on a native shrub in the Santa Catalina Mountains, has caused serious damage to chrysanthemums in one garden in Tucson, Ariz., through boring in the stems.

Relative resistance of the rice weevil, *Sitophilus oryza* L., and the granary weevil, *S. granarius* L., to high and low temperatures, E. A. BACK and R. T. COTTON (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 10, pp. 1043, 1044).—The authors have found that at various low temperatures the adults of these two species were killed about as follows: At 0° F., the rice weevil in 4 hours, the granary weevil in 5 hours; 5°, the rice weevil in 4.5 hours, the granary weevil in 7.5 hours; 15 to 20°, the rice weevil in 3 days, the granary weevil in 14 days; 20 to 25°, the rice weevil largely in 3 days, the granary weevil in 33 days; 25 to 30°, the rice weevil in 8 days, the granary weevil in 46 days; 30 to 35°, the rice weevil in 8 days, the granary weevil in 73 days; 35 to 40°, the rice weevil in 18 days, the granary weevil in 111 days; and at 40 to 45°, the rice weevil in 80 days and the granary weevil in 105 days. The eggs of the rice weevil perished after being exposed to a constant temperature of 30° for 4 days, whereas eggs of the granary weevil survived the exposure for a period of 28 days. Larvae of the rice weevil were killed by an exposure to a temperature of 30° for 11 days, while larvae of the granary weevil survived 44 days. There was no very great difference in the reaction of the two species to high temperatures, constant temperatures above 95° soon proving fatal

to both. A temperature of 120° killed adults of both species in 3 hours, and a temperature of 130° within 30 minutes. Oviposition was observed to cease at a constant temperature of 94°.

Sealed and unsealed brood, J. H. MERRILL (*Amer. Bee Jour.*, 65 (1924), No. 9, pp. 424, 425, fig. 1).—This contribution from the Kansas Experiment Station includes a graph showing the difference between the amount of sealed and unsealed brood. The observations indicate that it is an unsafe practice to judge the number of eggs deposited daily by the amount of sealed brood found in the hive.

The garden centipede, *Scutigera immaculata* (Newport), a pest of economic importance in the West, F. H. WYMORE (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 520-526).—It is pointed out that this pest is considered by economic entomologists of California, Oregon, and Utah to be one of the most destructive occurring in many truck-crop sections of these States. In California it is particularly destructive to asparagus shoots and seedlings of beans, peas, melons, etc., the injury being caused by its eating numerous small holes in the plant. It is stated that all stages in the life history of *S. immaculata* have been observed in the intensively cultivated asparagus fields.

Paradichlorobenzene and calcium cyanide used as soil fumigants have given encouraging results in controlling this and other soil pests, and more extensive experiments with these chemicals are in progress. In the asparagus fields of the Delta region of the Sacramento River, flooding has proved to be quite a practical means of control in several cases. The best results from flooding have been obtained where the fields were kept thoroughly and continuously covered to a depth of 1 ft. or more for from two to three weeks.

FOODS—HUMAN NUTRITION

Hygienic fundamentals of food handling, C. THOM and A. C. HUNTER (*Baltimore: Williams & Wilkins Co.*, 1924, pp. 228, pl. 1, figs. 23).—The scope of this volume, a contribution from the microbiological laboratory of the Bureau of Chemistry, U. S. D. A., is stated in the introductory section to be as follows:

"The constitution of foodstuffs as a primary factor in determining food handling processes is presented first, followed by the criteria of fitness for food, the principles underlying the processes of food preservation, the types and evidences of spoilage, food poisoning, and food infections. In a second section a series of groups of food products are discussed, and the principles developed in the earlier discussion are applied to such groups as the cereals, meat, poultry, eggs, milk, and vegetables."

Scalding, precooking, and chilling as preliminary canning operations, C. A. MAGOON and C. W. CULPEPPER (*U. S. Dept. Agr. Bul.* 1265 (1924), pp. 48).—This investigation supplements the authors' previous studies on various factors involved in canning processes (*E. S. R.*, 46, p. 663) by a critical study of the effect upon specified food materials of the processes of precooking, scalding, and scalding and chilling before canning. The effects of the different methods of treatment upon the appearance, flavor, and other qualities of the canned product were determined, and analyses were made of the total dry matter, sugar, protein, and ash before and after treatment. The food materials examined and the conclusions drawn concerning each are as follows:

In the canning of spinach some form of precooking is considered advantageous, chiefly to reduce the bulk of the material and render it more flexible and thus more easily packed. The internal pressure of the cans is also reduced,

and if the material is packed while still hot the time for heat penetration to the center of the can is lessened. Exposure to steam is preferable to scalding in water, as the loss of soluble material is less. No advantage is to be gained by plunging the freshly scalded spinach into cold water.

In the commercial canning of peas in tin, some form of scalding is considered necessary to reduce the internal pressure and increase the vacuum. For home canning in glass this is not necessary. The process does not, as commonly supposed, soften the finished product, improve the color, or produce a clearer liquor. Treatment with steam does not result in so great a loss of sugar and other water-soluble constituents as scalding in water.

The results with string beans were similar to those with spinach and peas. While steam is considered superior to water in many respects, scalding in water has the advantage of serving to clean the beans. No advantages were found in chilling the beans in cold water after scalding. With Lima beans, the only advantage in scalding was the elimination of air and consequent reduction of internal strain. No steam experiments were conducted.

The work on sweet corn included the effects of scalding on the cob and of precooking after the corn was cut from the cob without preliminary scalding. For comparison, some corn was cut from the cob and canned without precooking. The chief advantage of either scalding or precooking was in securing a proper vacuum, as noted in the previous publication. In no case was the natural color preserved better in the scalded or precooked than in the untreated corn. The chemical changes during the pretreatment were only slight, but were greater in the corn scalded on the cob than cut. The method recommended as most satisfactory is precooking to 80°C. prior to filling the cans for processing.

For tomatoes, scalding either with steam or boiling water followed immediately by chilling in cold water is considered essential for the removal of the skins.

With sweet potatoes the chemical changes on precooking were more pronounced than with any of the other vegetables. The amount of the change varied with the potato and the condition of storage. These changes have been noted in a previous publication (E. S. R., 47, p. 613).

Literature references on the relation of scalding to keeping quality are cited, showing that scalding alone or followed by chilling can not be relied upon to destroy spores or highly resistant forms of bacteria.

The general conclusions drawn as a result of this investigation are that some form of scalding is desirable in the preparation of most vegetables, especially if they are to be canned in tin, and that live steam, if available, is preferable to boiling water. The chief advantages in scalding are the reduction in bulk and expulsion of the air. In some cases this may obviate the necessity of an exhaust, while in others a good exhaust may serve the purpose of scalding. Chilling in cold water subsequent to scalding is of advantage only in the case of substances like tomatoes for temporary hardening of the pulp. Otherwise it has no appreciable effect on the quality, flavor, or appearance of the final product and adds considerably to the expense.

A list of 56 references to the literature cited is appended, together with a list of pertinent nontechnical literature on canning.

Concerning the relation of the bacterial count to the putrefaction of meat, J. WEINZIRL (*Amer. Jour. Pub. Health*, 14 (1924), No. 11, pp. 946-949).—To discover the cause of the discrepancies noted in the literature between the bacterial count and the degree of spoilage of meat, the bacteria in 40 samples of putrefying meat were isolated and identified and were then inoculated in pure cultures into sterile meat. On incubation, typical putrefaction was pro-

duced by the anaerobic but not by the aerobic or facultative anaerobic organisms. It is concluded that while the latter take part in the spoilage of the meat, the putrefactive odor is mainly due to anaerobes. A satisfactory test for anaerobes in meat comparable to the *Bacillus coli* test in water analysis is considered desirable.

Critical studies of Pirquet's nourishment theory, and on our new method, M. TSURUMI and K. NAKATATE (*Japan Med. World*, 4 (1924), No. 4, pp. 87-89).—As the result of a comparison of the nutritional status of 1,926 Japanese children and adults by the Pirquet method and by observations of the actual condition of the subjects, the conclusion is drawn that the Pirquet formula can not be applied to the Japanese. A modified formula which appeared to conform more closely to actual conditions uses one-half the body length instead of the sitting height, the formula being
$$\frac{100 \sqrt[3]{10 \times \text{body weight}}}{\frac{1}{2} \text{ body length}}.$$

The Pirquet method of determining nutritive requirements from the calculated area of the intestines is considered to be of doubtful value for Europeans and Japanese alike. It is thought that no definite relationship exists between the length of the intestines and the sitting height.

The composition of typical Korean diets, J. D. VANBUSKIRK (*Japan Med. World*, 4 (1924), No. 6, pp. 127-130).—This supplements an earlier study (E. S. R., 48, p. 858) of the food consumption of the people of Chosen (Korea). Tabulated data are given on the composition of a number of native foods analyzed by V. R. Rose and the calculated composition of other foods, and on the average daily consumption of food in terms of proteins, fats, carbohydrates (by difference), and calories calculated from 79 diet lists representing food consumed for one month furnished by 42 men and women from various classes.

The average amount of cooked rice and rice mixtures for both men and women was 1,725 gm. per day. The average amount of protein was 83.8 gm. for men and 76.8 gm. for women. The amount varied with the occupation, averaging 93.8 gm. for farmers and laborers, 84.1 for students, and 68.3 for office workers. Only about 22 gm. of protein daily was of animal origin. The average daily amount of fat was 21.1 gm. for men and 17.9 for women. The average calorie values were 2,678 for men and 2,380 for women. As noted in the earlier report, the diets are considered to furnish sufficient vitamin B and C, but to be somewhat deficient in vitamin A.

[Diet and the public health] (*Brit. Med. Jour.*, No. 3325 (1924), pp. 504-512).—This symposium, held at the 1924 meeting of the British Medical Association, consists of papers on The Importance of the Mineral Elements in the Maintenance of Health, by J. B. Orr; Common Errors of Diet in an Urban Population, by J. S. Manson; and Diet Control as an Instrument of Public Health Progress, by W. G. Savage, followed by a general discussion by H. Scurfield, R. Hutchison, et al.

The stability of the vitamin A of cod-liver oil towards the hardening process, S. S. ZILVA (*Biochem. Jour.*, 18 (1924), No. 5, pp. 881, 882).—Supplementing an earlier statement by Goldblatt and Zilva on the potency of hardened cod liver oil as a source of vitamin A (E. S. R., 50, p. 771), the author reports that samples of cod liver oil with melting points of 32 and 45° C., hardened under conditions excluding all traces of oxygen, were tested for growth-promoting properties before and after deodorization with steam at 125°. Partially hardened oils were also examined.

No appreciable loss in growth-promoting activity could be detected in the partially hardened oils and in the oil melting at 32°, whether deodorized or not, but the hardened oil melting at 45° was less potent than the corresponding unhardened oil.

A note on the durability of vitamin A of cod-liver oil, E. POULSSON (*Biochem. Jour.*, 18 (1924), No. 5, pp. 919, 920, figs. 2).—A sample of cod liver oil produced in 1893 was tested for its content of vitamin A on rats which had been living on a diet free from this vitamin. Daily doses of 2 mg. caused resumption of growth for 1 week only, 3 mg. some growth, and 5 mg. decided growth. While the content of vitamin A in the original oil is not known, the fact that fresh samples of Norwegian medicinal oil are effective in daily doses of between 1 and 2 mg. is thought to indicate that part of the original potency of the sample had been lost.

An experimental study of ophthalmia in rats on rations deficient in vitamin A, A. M. YUDKIN (*Arch. Ophthalmol.*, 53 (1924), No. 5, pp. 416-425).—Essentially noted from another source (*E. S. R.*, 50, p. 463.)

Experiment station work on the fat-soluble vitamins, S. L. SMITH (*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas.*, 1922, pp. 79-87).—This is a review of investigations in progress during 1922 at the State experiment stations on the fat-soluble vitamins and their rôle in animal nutrition, with particular emphasis on their relation to the metabolism of calcium and phosphorus.

A list of 32 references to the literature is appended.

The action of nitrous acid upon the antineuritic substance in yeast, R. A. PETERS (*Biochem. Jour.*, 18 (1924), No. 5, pp. 858-865).—In connection with attempts to concentrate the antineuritic vitamin in yeast, the author has made a careful study of the behavior of pigeons on polished rice and the conditions which must be met in curative tests. These are summarized as follows:

"Only those pigeons should be used for the test which show well-marked head retraction, in which the symptoms have appeared within 30-35 days, and which appear strong enough to withstand treatment. If the symptoms clear up completely upon administration of the extract within a period of 6-12 hours, recovery must be a persistent one for 2, or better 3, days in order to establish the activity of an extract. If the symptoms do not clear up, it is not proof of the nonactivity of an extract unless (a) the bird is strong, and (b) the extract is administered within 12 hours from the start of the convulsions if it is the first attack, and within 3 hours if it is the second."

As thus tested, histamine when given by mouth was found to have an occasional curative effect. Other substances of basic character were tested, but with at best only temporary results. The substances tested included sodium bicarbonate, hexylamine, guanidine, dimethyl urea, and urea. Olive oil caused no improvement in one case, improvement for 12, 30, and 45 hours in three other cases, and an apparent cure for 6 days in one case.

A method of preparing concentrates of antineuritic vitamin from yeast is described as follows: Yeast in 7-lb. lots is kept at room temperature for 2 days and then boiled with two successive 1,500-cc. amounts of tap water and filtered. To the combined filtrates is added 25 per cent neutral lead acetate in an amount just under that required for maximum precipitation (slightly more than 300 cc.), and the precipitate is filtered off. The filtrate is acidified with sulfuric acid and acid mercuric sulfate added to complete precipitation. After having stood overnight the precipitate is filtered off and the filtrate kept for another day and filtered again to remove the faint white precipitate formed. About 10 gm. of barium sulfide is added and the mixture filtered again. After the removal of sulfur and hydrogen sulfide, the filtrate is neutralized with sodium hydroxide, with litmus as indicator, acidified with acetic acid, and filtered. The active material at this point is taken up by the activated charcoal, Norit, in 30-gm. amounts, and is separated from the charcoal by heating on a water bath for 30 minutes with successive 300-, 150-, and 150-cc. portions of 50

per cent alcohol containing 1 cc. of concentrated HCl per 100 cc., and the alcoholic extract evaporated in vacuo at a temperature not over 60° C. to about 20 cc.

Of the concentrate thus prepared, about 0.05 cc. is said to cure a polyneuritic pigeon within 6 hours and keep it from convulsions on a polished rice diet for about 3½ days. On drying at 100°, this amount furnishes about 10.5 mg. of solids, of which 1.2 mg. is ash. The extract from which hydrochloric acid has not been removed is said to be stable for several months at room temperature. Treatment with nitrous acid causes no appreciable destruction of the activity. This is considered of importance as excluding primary amines and many secondary amines as being responsible for antineuritic action.

Metabolism investigations in avitaminosis [trans. title], G. SHINODA (*Pfűger's Arch. Physiol.*, 203 (1924), No. 1-4, pp. 365-393).—This is a summary of an extensive series of vitamin studies conducted at the Pharmacological Institute of the Imperial University at Tokyo and hitherto reported chiefly in Japanese literature. The investigations were similar in scope and results obtained to those conducted in Berlin by Bickel and his coworkers (E. S. R., 50, pp. 860-863).

Lack of exercise as a determining factor in the epidemiology of beriberi, D. B. BLACKLOCK (*Brit. Med. Jour.*, No. 3311 (1924), pp. 1046, 1047, fig. 1).—During an investigation of the occurrence of beriberi in a prison at Freetown, Sierra Leone, it was noted that the highest incidence was among the prisoners employed as tailors. Lack of exercise was suggested as a contributing factor and was confirmed by experiments conducted on fowls. Fowls which were kept in close confinement on a diet of polished rice and water contracted polyneuritis at a very much earlier date than those allowed free exercise.

In commenting upon these observations, attention is called to the fact that "beriberi is notoriously a disease which occurs in institutions and in places where a fixed diet and some degree of confinement are almost constantly present—for example, prisons, asylums, ships, etc. It is important for those in charge of institutions to realize that such useful occupations as tailoring, mat weaving, and basket making are not such as to provide sufficient exercise."

The mineral content of human milk in normal and rachitic families, S. V. TELFER (*Biochem. Jour.*, 18 (1924), No. 5, pp. 809-813).—Data are reported on the content of fat, ash, calcium, and phosphoric acid in samples of breast milk from 12 mothers of nonrachitic and 15 of rachitic infants in the city of Glasgow, Scotland, and from 12 healthy women in country villages. The samples in most cases were obtained by exhausting the breast artificially. The period of lactation varied from 5 days to 13 months. The average results for the three groups in the order noted above were, fat 2.24, 2.85, and 3.17 per cent; ash 0.196, 0.195, and 0.196; CaO 0.047, 0.047, and 0.042; and P₂O₅ 0.04, 0.039, and 0.044 per cent. As shown by these data, there were no appreciable differences in the composition of the milk whether the infants developed rickets or not.

Pellagra in relation to milk supply in the household, G. A. WHEELER (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 35, pp. 2197-2199).—Observations are reported on the influence of variation in only one item of food (milk) on the incidence of pellagra in three households in South Carolina. In all cases the removal of milk from the diet was followed in about 3½ months by the onset of pellagrous symptoms in some members of the family. With the resumption of milk the symptoms promptly disappeared. "The sensitiveness of these

border-line dietaries to what would appear on the surface to be a trifling change in some one of the meagerly provided essentials is a point that can not be over-emphasized in the prevention and control of the disease."

Unique dietary needs for lactation, H. M. EVANS (*Science*, 60 (1924), No. 1540, pp. 20-22, figs. 2).—Evidence that natural foods contain a substance or substances essential for lactation is presented as follows: Female rats on a diet of purified casein 18, starch 54, lard 15, and salts 4 per cent, together with butter as a source of vitamin A and yeast of vitamin B, showed fertility in the first litter, followed by sterility which could be prevented or cured by the administration of small amounts of vitamin X as in the form of from 1 to 6 gm. of wheat germ daily. About 100 young of female rats on such a purified diet showing first litter fertility and 300 young of female rats in which fertility was induced, by vitamin X have been raised to weaning age. These have invariably weighed at weaning only about half the normal weight of rats at this age.

When the young of pure food mothers are allowed to suckle normal rats they have been shown to grow at a normal rate, while normal young suckled by pure food rats show the same small increase in weight as the young of the pure food rats.

Among the materials favoring lactation are fresh green (but not dried) leaves, wheat embryo (in considerable amounts), egg yolk, and meat. On extracting the egg yolk and wheat embryo with fat solvents the fat-free residue is also effective, thus indicating that the substance influencing lactation does not belong to the class of fat-soluble vitamins. It is suggested that the substance may belong to the class of specific stimulants such as bios.

Glycerin, its use as an antiketogenic substance in the diet of diabetic patients, H. M. THOMAS, JR. (*Bul. Johns Hopkins Hosp.*, 35 (1924), No. 401, pp. 201-206).—Complete case reports over a long period of time are given of two diabetic patients in whom ketosis was prevented by the substitution of from 30 to 40 gm. of glycerin for the corresponding amount of carbohydrates. It is considered that the use of glycerin in diabetic diets should be confined to cases in which the carbohydrate tolerance is slightly lower than that of a maintenance diet.

Insulin and the nature of diabetes mellitus, P. J. CAMMIDGE (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 18, pp. 1423-1426).—In this discussion the author emphasizes the fact that the deficiency in pancreatic hormone resulting in hyperglycemia and diabetes may be relative, depending upon the inability of a normal pancreas to supply a sufficient amount for excessive glycogenolysis, or absolute, due to functional or organic defects in the gland. Evidence is also advanced that a relative deficiency may become absolute if the metabolic disturbances giving rise to it are not checked, and that often what was considered an absolute deficiency becomes relative under suitable dietetic treatment. In cases of absolute deficiency the use of insulin must be continued indefinitely, while the conditions causing relative deficiency may be so corrected that the insulin may be discontinued. The importance is, therefore, emphasized of determining the exact condition in each case of diabetes in order to obtain satisfactory and lasting results.

Effect of direct sunlight, diffuse daylight, and heat on potency of botulinus toxin in culture mediums and vegetable products, XXIV, P. SCHOENHOLZ and K. F. MEYER (*Jour. Infect. Diseases*, 35 (1924), No. 4, pp. 361-389, figs. 3).—Studies on the destruction of botulinus toxin, types A and B, by various treatments are reported with the following results:

The toxin produced by the growth of *Bacillus botulinus* in glucose peptone veal infusion broth and in vegetables was destroyed by exposure to direct sun-

light in open tubes in from 90 to 118 hours. A longer time was required when the liquid was kept under anaerobic conditions by a covering of sterile petrolatum, and still longer when exposed to the action of diffuse daylight and air at room temperature. Under such conditions a noticeable reduction in toxicity took place in about 2.5 months. In the absence of air and light the rate of destruction was still slower. A sample of toxic spinach kept in the ice box for 5 months or more showed only a slight loss in potency.

Centrifuged toxins prepared from cultures of *B. botulinus* in suitable media were destroyed by heating to 80° C. for from 4 to 10 minutes, but liquor from contaminated home-canned or commercially-canned products proved more resistant. Three samples of centrifuged toxic asparagus juice were still toxic after heating at 80° for from 4 to 10 minutes, 1 of beet liquor after 10 minutes, 1 of string bean juice after 12 minutes, 2 of corn juice after from 40 to 60 minutes, and 1 of pea juice after 45 minutes. In another sample of pea juice the toxin was destroyed in 15 minutes. The whole toxic vegetable liquors were more resistant than the centrifuged juice. Whole asparagus liquor was toxic after heating for 50 minutes, beets and string beans 60 minutes, and spinach from 12 to 60 minutes.

Canned vegetables either naturally or artificially contaminated with *B. botulinus* were cooked over an open flame for varying periods and finally tested for toxicity by feeding the material to guinea pigs instead of using subcutaneous injections as in the other experiments. In the case of commercially-canned beets artificially contaminated with *B. botulinus* and incubated at 35°, heating for from 7 to 20 minutes above 80° was necessary to destroy the toxin. On removing the liquor and adding an equal volume of water, the product was rendered avirulent as soon as the temperature had risen above 85°. The contents of 3 cans of artificially contaminated corn and 1 of toxic home-canned corn heated over an open gas flame for from 17 to 50 minutes, during which time the temperature was over 80° for from 9 to 42 minutes, respectively, were still toxic. Similar results were obtained with canned peas, and canned spinach was even more resistant. The toxin in string beans was more easily destroyed.

In commenting upon these results, the danger is emphasized of eating suspicious canned products even after they have been reheated. "The only protection against botulism remains therefore in the proper education of the public to use adequately processed food products, whether commercially or home-canned. Visibly spoiled canned food should not be made safe by re-cooking. It should be destroyed by adding to the jar a fair amount of commercial lye, which is commonly used in the household. The heat generated will not only destroy the botulinus toxin, but will in conjunction with the high degree of alkalinity either destroy or materially reduce in number the potentially dangerous spores of *B. botulinus* present in the food."

The calcium content of the blood serum in cases of gout, V. COATES and P. C. RAIMENT (*Biochem. Jour.*, 18 (1924), No. 5, pp. 921-924).—As determined by the Kramer-Tisdall method, the blood serum of seven subjects suffering from gout contained from 16 to 24 mg. of calcium per 100 cc. of blood. The average of eight determinations (two on the same subject) was 18.87 mg. Evidence is given that the rise in calcium concentration above normal values is due to gout and not to any extraneous factors.

ANIMAL PRODUCTION

Range investigations by the experiment stations, W. H. BEAL, G. HAINES, W. A. HOOKER, and J. I. SCHULTE (*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas.*, 1922, pp. 113-126).—A summary of the contributions

of the State agricultural experiment stations to the solution of range problems, including a list of 130 references.

A study of pasture values and pasture methods for horses, cattle, sheep, and swine (*Kansas Sta. Bien. Rpt. 1923-24, p. 95*).—In a study of pastures, Sudan grass was found to suffer more from chinch bugs than any other crop or forage. Cowpeas were found unpalatable as a pasture crop for sheep, but the hay made from them was readily eaten by the same animals.

[Feeding experiments with beef cattle at the Illinois Station] (*Illinois Sta. Rpt. 1923, pp. 14-16*).—In a comparative test of the value of cottonseed meal, soy bean meal, and ground soy beans as supplements to corn for fattening mature steers in dry lot on short, heavy feed, it was found that cottonseed meal was the most palatable and produced the most rapid gains and the best finish, but less feed was required by the lot receiving soy bean oil meal. Ground soy beans were not only the least palatable, but they caused scouring.

Using eight Hereford cows, the following coefficients of digestibility were obtained for silage made from the stover of shocked corn when supplemented in the ration with soy bean oil meal: Dry matter 56.9 per cent, crude protein 55.6, ether extract 64.4, nitrogen-free extract 58.8, and crude fiber 66.6 per cent. The average figure obtained for metabolizable energy was 58.2 per cent.

Steer feeding [at the Kentucky Station] (*Kentucky Sta. Rpt. 1923, pt. 1, p. 48*).—Two lots of 10 steers each were selected for comparing the rapidity and economy of gains made during 123 days on silage alone and when part of the silage was replaced by clover hay after the first 70 days of the experiment. The former lot received average daily rations of 13.77 lbs. of shelled corn, 2.74 lbs. of cottonseed meal, 23.01 lbs. of silage, and 0.8 lb. of straw, making average daily gains of 2.18 lbs. The other lot received an average daily ration of 13.91 lbs. of shelled corn, 2.66 lbs. of cottonseed meal, 39.92 lbs. of silage, 11.9 lbs. of clover hay, and 0.54 lb. of straw, making average gains of 2.35 lbs. per day.

The use of a limited amount of molasses in fattening yearling steers, E. A. TROWBRIDGE (*Missouri Sta. Bul. 223 (1924), pp. 16, fig. 1*).—A test of the advisability of adding 1 lb. of cane molasses to rations of yearling steers was conducted over a period of 140 days. The rations, which were full fed to the different lots of 8 steers each, were as follows: Lot 1, shelled corn, linseed meal, corn silage, and alfalfa hay; lot 2, shelled corn, linseed meal, corn silage, alfalfa hay, and cane molasses; lot 3, shelled corn, alfalfa hay, corn silage, and cane molasses; lot 4, shelled corn, linseed meal, alfalfa hay, and cane molasses; and lot 5, shelled corn, alfalfa hay, and cane molasses. The lots receiving linseed meal received this feed in the ratio of 1 lb. to 6 lbs. of corn. Hogs followed the steers in all lots. The results of the experiments are summarized in the table below:

Value of adding 1 lb. of cane molasses to various rations for yearling steers

Lot	Average initial weight	Average daily gain per steer	Average pork produced per steer	Feed consumed per 1 lb. of gain					Selling price per 100 lbs.	Dressing percentage
				Shelled corn	Linseed oil meal	Corn silage	Alfalfa hay	Molasses		
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.		Per ct.
1-----	638.23	2.96	33.75	5.67	0.94	3.94	0.86	-----	\$10.00	59.04
2-----	651.62	3.00	28.12	5.52	.91	3.38	.84	0.32	10.00	59.85
3-----	643.87	2.73	24.37	6.21	-----	4.06	1.03	.36	9.25	59.24
4-----	653.71	3.04	43.00	5.55	.92	-----	1.71	.32	10.00	59.83
5-----	650.08	2.97	21.50	6.02	-----	-----	2.17	.33	9.65	58.17

Can the Montana farmer fatten beef cattle for market? C. N. ARNETT (*Montana Sta. Rpt. 1923, pp. 21-23*).—For determining the costs of fattening grade Hereford steers in Montana, two lots of 10 yearlings and one lot of 12 two-year-olds were fed during a 150-day test. The rations of the yearlings consisted of 9 lbs. of grain and 13.67 lbs. of hay daily for one lot, while the other lot received the same daily grain ration and one-half the amount of hay, together with 14.4 lbs. of sunflower silage. The two-year-olds received 12 lbs. of grain, about 8.5 lbs. of hay, and about 20 lbs. of sunflower silage per day.

The average daily gains made by the three lots were, respectively, 1.71, 1.88, and 1.85 lbs., the calculated costs per pound of gain being 12, 10.67, and 15.4 cts. The profits per steer were calculated at \$7.10 for the yearlings receiving no silage, \$9.84 for the yearlings receiving silage, and \$2.71 for the two-year-olds, based on feed costs of \$9 per ton for hay, \$3.50 per ton for sunflower silage, and \$1.60 per hundredweight for grain.

Fattening calves, yearlings, and two-year-olds, G. BOHSTEDT (*Ohio Sta. Mo. Bul., 9 (1924), No. 9-10, pp. 175-183, figs. 6*).—In continuing the comparative feeding tests with calves, yearlings, and 2-year-olds (E. S. R., 50, p. 170), 60 Herefords were secured from Colorado in the fall of 1923. The calves were on experiment for 182 days, the yearlings 154 days, and the 2-year-olds 126 days.

A lot of each age received a ration of corn, clover hay, silage, and oil meal, on which average daily gains of 2.23 lbs., 2.32 lbs., and 2.65 lbs. were made by the calves, yearlings, and 2-year-olds, respectively. When ground soy beans replaced the oil meal in the rations of yearlings the average daily gain was 2.18 lbs. This lot sold for 25 cts. less per 100 lbs. on the market. A lot of yearlings receiving corn, clover hay, and silage made an average daily gain of 2.16 lbs. On a ration of corn, soy bean hay, and silage the gain averaged 2.22 lbs. per day, but the selling price was 25 cts. lower per 100 lbs. than in the above lot. The younger steers required less feed per 100 lbs. of gain and the selling price was uniformly higher, thus making the profits greater.

Full feeding of calves on grass versus full feeding in a dry lot during summer months after having been carried through the winter on virtually a maintenance ration the basis of which was silage (*Kansas Sta. Bien. Rpt. 1923-24, p. 92*).—One lot of calves wintered on a ration of 22.86 lbs. of cane silage and 3.5 lbs. of alfalfa per head daily made average gains of 65.3 lbs. per head, while a second lot on a ration of 22.84 lbs. of cane silage and 1 lb. of cottonseed meal per head daily made average gains of 84.6 lbs. during the winter period. In the spring one-half of each lot was full fed in dry lot, while the other half was full fed while on bluestem pasture throughout the summer. The results indicated that full feeding during the winter and marketing in the spring was the more profitable procedure for calves. Full feed on pasture during the summer was more profitable than dry lot feeding.

[Experiments with sheep at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1923-24, pp. 94, 95, 96*).—The results of experiments in sheep production are briefly noted.

Feeding western lambs.—In a comparison of various roughages for fattening lambs when fed with shelled corn, the following efficiencies were calculated: Alfalfa 100 per cent, sweet clover 95 per cent, cowpea hay 87 per cent, and Sudan grass hay 56 per cent. In other comparisons corn was found to have an efficiency of 100 per cent as compared with 96 per cent for unthreshed kafir heads and 90 per cent for threshed kafir.

Farm flock management.—In a test of the advisability of purchasing old ewes for fall breeding and marketing them with their lambs in the spring, 50 old ewes weighing 119 lbs. each were purchased and bred to Hampshire, Shropshire, and Dorset rams. The ewes averaged 131 lbs. in weight in June and

produced 8 lbs. of wool. The lambs of the Hampshire ram averaged 70.3 lbs., of the Shropshire ram 64.3 lbs., and of the Dorset ram 69.2 lbs.

Effect of age upon yield of wool (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 49, 50*).—By determining the weights of the fleeces of the sheep in the station flock from 1916 to 1923, it was shown that the amount of wool decreased as the age increased. The weights of the fleeces of yearling sheep were found to be fairly accurate indicators of the animals' future wool production.

[Lamb feeding experiments at the Illinois Station] (*Illinois Sta. Rpt. 1923, pp. 16, 17*).—Six lots of 25 lambs each were used for comparing the feeding value of soy bean hay, soy bean straw, alfalfa hay, soy beans, soy bean oil meal, and linseed oil meal. The results indicated that soy bean oil meal and linseed oil meal are approximately equal in value, and that both are slightly superior to the ground bean. Equal gains were produced with alfalfa and soy bean hay, though the former was more efficiently utilized and less concentrates were required per unit of gain.

Lamb feeding investigations, 1922-23, A. M. PATERSON and H. W. MARSTON (*Kansas Sta. Circ. 109 (1924), pp. 4, fig. 1*).—The results of these experiments have been previously noted (E. S. R., 50, p. 573).

Some lamb-feeding results secured by the Kansas Agricultural Experiment Station, A. M. PATERSON (*Kansas Sta. Circ. 108 (1924), pp. 8, fig. 1*).—The author has briefly reported the results of experiments in comparing rations for fattening lambs conducted from 1914 to 1922 at the station and previously noted from other sources.

Fattening lambs with barley and alfalfa, C. E. FLEMING (*Nevada Sta. Bul. 106 (1924), pp. 14, figs. 5*).—The results of three 70-day feeding trials in comparing rations of alfalfa hay alone with alfalfa hay plus 0.25, 0.5, 0.75, and 1 lb. of barley per day are combined and summarized in the following table:

Lamb feeding trials, 1920-1922, with barley and alfalfa

Lot	Ration	Number of lambs per lot	Average initial weight	Average daily gain	Average feed consumed per 100 lbs. gain	
					Alfalfa hay	Barley
			Lbs.	Lbs.	Lbs.	Lbs.
1.....	Alfalfa hay alone.....	25	53.0	0.175	1,743	-----
2.....	Alfalfa hay plus 1 lb. barley.....	25	52.5	.307	635	326
3.....	Alfalfa hay plus 0.75 lb. barley.....	25	53.5	.271	822	276
4.....	Alfalfa hay plus 0.5 lb. barley.....	25	54.0	.235	1,035	212
5.....	Alfalfa hay plus 0.25 lb. barley.....	25	52.0	.207	1,299	121

The results in four commercial lamb feeding corrals, based on records of 11,203 lambs, which are tabulated, were similar to those obtained in the station experiments. The use of good leafy alfalfa was shown to reduce the grain requirements. The feed costs and profits are discussed, as well as variations in the gains made by individuals on the same ration.

Feeding lambs for market, D. S. BELL and G. BOHSTEDT (*Ohio Sta. Mo. Bul., 9 (1924), No. 9-10, pp. 168-173, figs. 3*).—The results are reported of an experiment in comparing the feeding qualities of western lambs with native Ohio mutton and fine wool lambs during fall and winter feeding periods. In the fall feeding experiment, from September 27 to December 7, the western lambs made average daily gains per head of 0.396 lb. as compared with 0.367 lb. by the native fine wool lambs and 0.277 lb. by the native mutton lambs. The native mutton lambs were infested with stomach worms and treated during the experiment, which undoubtedly accounted for their poor gains.

For the winter feeding experiment, from December 27 to April 10, the native lambs were treated for stomach worms. Both the western lambs and the

native mutton lambs made average daily gains of 0.356 lb. in this experiment, while the native fine wool lambs gained 0.290 lb. The native fine wool lambs, however, sheared over 2.5 lbs. more wool per lamb than the other lots. The calculated profits per lamb in both experiments were higher for the native Ohio stock.

[Experiments with swine at the Illinois Station] (*Illinois Sta. Rpt. 1923, p. 16*).—In a comparison of chuffy, intermediate, and rangy types of Poland China pigs for market production, which were fed to a final weight of 225 lbs., the intermediate type of pig was found to make the most rapid gains and to require the least feed for maintenance.

A sow which previously lost her third and fourth litters, due to a vitamin A deficiency when being fed on white corn, carried her fifth and sixth litters to maturity when a little cod liver oil was added to the ration. Nine out of ten 50-lb. pigs receiving a ration of white corn and tankage died before reaching marketable weight. Another lot of 10 pigs receiving a small addition of cod liver oil to the ration was successfully raised to a weight of 275 lbs.

[Investigations with swine at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1923-24, pp. 89-91, 93, 94, 96, 97*).—The results of experiments in swine production are briefly noted.

The nutritive requirements of swine.—Four different rations have been compared for feeding brood sows: (1) White corn, tankage, and bone ash; (2) white corn, tankage, bone ash, and butterfat; (3) white corn, tankage, bone ash, and sprouted oats; (4) white corn, tankage, bone ash, alfalfa, sprouted oats, and cod liver oil; and (5) white corn, tankage, bone ash, alfalfa, sprouted oats, butterfat, and cod liver oil. The sows on the first three rations showed irregular breeding, and the pigs farrowed were weak in all but one litter, while the pigs farrowed by the sows on the fourth ration were big and strong. Ration 5 had not been going long enough for results.

Hogging down corn.—In comparing the relative efficiency of corn and kafir for hogging down, lots of hogs were turned into each crop on September 13 and October 13, and it was found to require 2.4 and 4 bu. more kafir than corn to produce 100 lbs. of gain in the respective trials. It required 21.32 lbs. more of the mature corn to produce a like gain than of the immature corn.

In another trial a 40-day hogging-down period was compared with 30- and 60-day hand-feeding periods. The amounts of corn required to produce 100 lbs. of gain in the hogging-down period were 8.7 bu., in the 60-day hand-feeding period 6.6 bu., and in the 30-day hand-feeding period 4.9 bu. The hand-fed pigs made average daily gains of 2.14 lbs. as compared with 1.53 lbs. by the pigs hogging down corn. Wet weather is considered responsible for a wastage of corn in the hogging-down experiments.

Mineral supplements in swine feeding.—The results of a test in which various mineral supplements were added to rations of corn and tankage and corn, tankage, and alfalfa hay for fattening pigs showed that practically no benefit resulted from the additions of mineral supplements to the latter ration.

The influence of exercise on reproduction in hogs.—Four lots of 2 sows each were used for comparing the effects of exercise on the weights of the pigs at farrowing and weaning when receiving rations of corn alone or corn and tankage. The pigs from sows fed corn alone and having exercise were practically as big as the pigs of sows receiving corn and tankage without exercise.

Growing stocker pigs.—In a comparison of the production of stockers from various sized spring pigs, it was found that the larger and older pigs made better use of their feed and attained a weight of 100 lbs. by September 15. More time and more feed were required for the production of a similar weight by smaller and younger pigs.

[Hog feeding experiments at the Kentucky Station] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 48, 49*).—Another year's results of the hog feeding experiments at the station are reported (*E. S. R., 49, p. 571*).

Hogging-down experiments.—"Four one-acre plats were used. Corn hogged down, with tankage self-fed, gave a net profit of \$39.10 per acre; corn hogged down, with a mineral mixture self-fed, gave a net profit of \$36.73 per acre; corn and soy beans grown together hogged down, with a mineral mixture self-fed, gave a net profit of \$36.24 per acre; and corn and soy beans hogged down, with no mineral mixture, gave a net profit of \$17.15 per acre."

Barley for fattening hogs.—Five lots of pigs were used for comparing different methods of feeding barley, the following being the average daily gains made and the amount of feed required per 100 lbs. of gain on the different rations: 0.92 lbs., requiring 658 lbs. of grain on a ration of dry whole barley hand-fed; 1.2 lbs., requiring 506 lbs. of grain on a ration of dry whole barley hand-fed plus a self-fed mineral mixture; 1.04 lbs., requiring 607 lbs. of grain on a ration of whole barley soaked 24 hours hand-fed; and 1.32 lbs., requiring 480 lbs. of grain on a ration of whole barley soaked 24 hours plus a mineral mixture self-fed.

Feed requirements and cost of gains of spring and fall pigs, E. F. FERRIN and M. A. McCARTY (*Minnesota Sta. Bul. 213 (1924), pp. 3-18, fig. 1*).—The results are reported of comparisons during two winters in dry lot and two summers on pasture and in dry lot of protein supplements for fattening spring and fall pigs. The rations fed were as follows: (1) Shelled corn, red dog flour, tankage, and semisolid buttermilk; (2) shelled corn, red dog flour, linseed meal, and semisolid buttermilk; and (3) shelled corn, red dog flour, tankage, and linseed meal. The semisolid buttermilk was hand-fed, while all other feeds were self-fed by the free choice method, together with a mineral mixture. All lots consisted of 10 pigs each and a total of 18 lots were fed, lots 1, 2, and 3 being on test during the first winter and lots 10, 11, and 12 during the second winter, while lots 4, 5, and 6, and 13, 14, and 15 were fed in dry lot, and lots 7, 8, and 9, and 16, 17, and 18 were on alfalfa pasture during the first and second summers, respectively. The pigs were fed to an average weight of 200 lbs. The results are summarized in the following table:

Comparison of protein supplements for swine

Lot	Ration	Season and condition	Average initial weight	Average daily gain	Days on feed	Feed consumed for 100 lbs. gain				
						Shelled corn	Red dog flour	Tankage	Linseed meal	Semisolid buttermilk
			Lbs.	Lbs.		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1	I	Winter.....	57	1.52	100	264	45	30	—	65
2	II	do.....	58	1.23	100	236	86	—	28	81
3	III	do.....	57	1.44	100	273	48	35	7	—
4	I	Summer in dry lot.....	53	1.60	91	287	21	25	—	45
5	II	do.....	53	1.14	129	294	58	—	16	65
6	III	do.....	53	1.58	93	285	23	37	9	—
7	I	Summer on pasture.....	57	1.56	92	298	9	21	—	46
8	II	do.....	58	1.33	107	336	11	—	10	55
9	III	do.....	59	1.23	116	341	5	25	3	—
10	I	Winter.....	56	1.52	96	265	60	31	—	32
11	II	do.....	56	1.19	121	260	112	—	18	54
12	III	do.....	56	1.44	101	300	44	37	14	—
13	I	Summer in dry lot.....	55	1.48	100	253	81	18	—	61
14	II	do.....	55	1.39	105	281	73	—	9	65
15	III	do.....	56	1.22	119	299	69	37	1	—
16	I	Summer on pasture.....	55	1.25	116	261	61	20	—	73
17	II	do.....	55	1.38	106	269	60	—	7	66
18	III	do.....	55	1.47	101	248	80	31	1	—

¹ The average final weight of this lot was only 156.3 lbs.

² Five pigs from this lot developed paralysis and were discontinued after 60 days.

The ration containing linseed meal without tankage was uniformly the least satisfactory throughout, even though these lots also received semisolid buttermilk. Ration 3, which lacked semisolid buttermilk, was the most economical and produced nearly as rapid gains as ration 1. The fall pigs gained as rapidly and required only a very little more feed than spring pigs on the average, but the need of more care is pointed out.

[Experiments with swine at the Montana Station] (*Montana Sta. Rpt. 1923, pp. 24, 25, 47, 48, 58, 59*).—The results of several experiments in feeding swine are briefly reported.

Does it pay to grind or soak barley fed to pigs? C. N. Arnett.—In a comparative test of different methods of feeding barley to pigs, it was found that 6 per cent less feed was required when the barley was ground, but that no advantage resulted from soaking the barley. Moreover, it required 12 per cent more time for finishing with soaked whole barley and 20 per cent more time with dry whole barley than with ground barley.

What dry land pasture to use for hogs, D. Hansen.—In comparing various pastures with dry lot feeding for hogs at the Huntley Substation it was calculated that an acre of peas would save 229 lbs. of grain, an acre of rye 234 lbs. of grain, an acre of brome grass 263 lbs. of grain, and an acre of dry land alfalfa 576 lbs. of grain. Five hogs cleaned up an acre of corn (light crop) in 9 days, making gains of 1.75 lbs. per day.

Barley and rye as feeds for hogs, G. Morgan.—Four tests of the relative values of barley and rye and combinations of the two have been made at the North Montana Substation. Barley proved the more palatable and produced more rapid gains, but rye produced a larger percentage of lean meat in the carcasses.

Peanuts for fattening hogs in the dry lot, J. C. GRIMES and W. D. SALMON (*Alabama Sta. Bul. 223 (1924), pp. 12*).—The results of three experiments in comparing different rations, including runner peanuts, for fattening hogs in dry lot are reported. The rations consisted of lot 1 peanuts; lot 2 peanuts and shelled corn; lot 3 peanuts and 60 per cent tankage; and lot 4 peanuts, shelled corn, and 60 per cent tankage. All rations were self-fed, and the choice in selecting each feed was left to the pigs. All lots also received a simple mineral mixture. The comparative data obtained in the experiments are summarized in the following table:

Comparison of peanut rations for fattening hogs in dry lot

Experiment	Length of trial	Lot	Number of hogs	Average initial weight	Average daily gain	Feed per 100 pounds gain			
						Peanuts	Shelled corn	Tankage	Cost ¹
	Days			Pounds	Pounds	Pounds	Pounds	Pounds	
I.....	97	{ 1	6	116	1.98	356	-----	-----	\$5.34
		{ 2	6	117	1.69	247	183	-----	7.36
		{ 3	6	116	2.06	354	-----	5.7	5.48
		{ 4	6	117	1.88	290	117	6.3	6.89
II.....	75	{ 1	6	76	1.58	357	-----	-----	8.92
		{ 2	6	76	1.65	292	115	-----	8.85
		{ 3	6	75	1.82	350	-----	21.6	9.49
		{ 4	6	75	2.02	273	86	10.9	8.33
III.....	60	{ 1	6	122	2.54	373	-----	-----	13.04
		{ 2	6	123	2.42	196	199	-----	10.41
		{ 3	6	121	2.74	350	-----	5.9	12.47
		{ 4	6	123	2.61	231	135	4.7	10.64

¹ Feed prices: Peanuts \$30, \$50, and \$70 per ton; corn \$1.12, 75 cts., and \$1 per bushel; and tankage \$65, \$70, and \$75 per ton during the respective experiments.

The experiments showed that peanuts with a mineral mixture made a satisfactory ration for fattening hogs, and that less feed was required per 100 lbs. of gain than when corn or tankage or both were included. The objection to the rations, however, was that all the pigs in all lots killed soft or oily in the first two experiments. Slaughter data were not obtained for the third experiment.

The practical use of the different rations is discussed, based on the market value of the feeds employed.

Peanut meal as a protein supplement to corn for fattening hogs in the dry lot, J. C. GRIMES and W. D. SALMON (*Alabama Sta. Bul. 224 (1924), pp. 16*).—The results are reported of five experiments in comparing the value of peanut meal with tankage as supplements to corn for fattening pigs in dry lot and to study the influence of peanut meal on the quality of the pork produced. Three kinds of peanut meal were fed. Two kinds included the hulls and were guaranteed to contain 30 or 36 per cent of protein, while the other kind was made from the shelled nuts and was guaranteed to contain 41 per cent of protein. In the third and fourth experiments, hogs were removed from the test at intervals for the determination of the hardness of the carcass. The method of feeding the rations for each lot, gains, and feed consumption per unit of gain may be obtained from the following table:

Feeding experiments with hogs in dry lot on rations including peanut meal

Experiment	Lot	Average length of period	Method of feeding	Average initial weight	Average daily gain	Feed consumed per 100 pounds of gain				
						Corn	Tankage	Peanut meal		
								30 per cent protein	36 per cent protein	41 per cent protein
		Days		Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1.....	1	104	Hand-fed.....	54	1.14	373	46.5	-----	-----	-----
	2	104	do.....	54	1.11	216	-----	216	-----	-----
	3	104	do.....	54	1.12	277	-----	139	-----	-----
	4	104	do.....	54	1.18	304	-----	101	-----	-----
2.....	1	101	do.....	84	1.21	429	43.0	-----	-----	-----
	2	101	do.....	83	1.25	394	-----	56	-----	-----
	3	101	do.....	84	1.31	255	-----	255	-----	-----
	4	101	Free choice.....	85	1.08	420	-----	80	-----	-----
3.....	1	69	Hand-fed.....	97	1.33	397	-----	-----	57	-----
	2	69	do.....	98	1.31	230	-----	-----	230	-----
	3	69	Free choice.....	94	1.35	320	-----	-----	97	-----
	4	69	do.....	95	1.48	258	-----	-----	-----	115
4.....	1	72.5	Hand-fed.....	87	1.28	378	-----	-----	54	-----
	2	72.5	do.....	85	1.47	194	-----	-----	194	-----
	3	70	Mixed, self-fed.....	86	1.25	286	-----	-----	143	-----
	4	70.4	do.....	85	1.42	243	-----	-----	-----	121
5.....	1	66	do.....	76	1.55	274	-----	137	-----	-----
	2	57	do.....	132	1.75	303	-----	151	-----	-----

It was found to make very little difference in the rations as to whether they consisted of equal parts of corn and peanut meal or 7 parts of corn to 1 part of peanut meal. A little more feed was required when the larger amounts of corn were included. The most economical ration will depend on the relative prices of corn and peanut meal. The composite results of the two experiments in which hull-free peanut meal was fed showed that the average daily gains were 0.16 lb. higher and the amount of feed required per 100 lbs. of gain was 44.3 lbs. less than when the pigs received comparable rations in which the peanut meal included the hulls.

Comparison of soybean oilmeals for supplementing corn for hogs, W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 145-149, figs. 3).—The analysis and comparative feeding value for hogs of soy bean oil meal prepared by various methods have been determined. Twelve lots of 6 pigs each averaging about 51 lbs. in weight were selected for making the tests. Each ration was self-fed to one lot and hand-fed to a second lot. Corn and minerals were employed as the basis of all rations. The average daily gains to 200 lbs. in weight with self-feeding and hand-feeding rations, including the different supplements, were as follows: Hydraulic or old-process soy bean oil meal 1.07 and 0.91 lbs., solvent soy bean oil meal 1.12 and 0.77 lbs., raw-tasting expeller soy bean oil meal 0.93 and 0.76 lb., nutty-flavored expeller soy bean oil meal 0.99 and 1.05 lbs., ground soy beans 0.78 and 0.81 lb., and tankage 1.21 and 1.02 lbs.

Many of the self-fed pigs developed lameness, which materially influenced the gains, while none of the hand-fed pigs became lame, probably due to their larger mineral consumption and slower growth. The meals, placed in the order of feeding value as supplements to corn, were nutty-flavored expeller oil meal, hydraulic oil meal, solvent oil meal, and raw-tasting expeller oil meal. Cooking or making into oil meal was recommended for improving the feeding value of ground soy beans.

Corn substitutes for hogs, W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 150-153).—The advisability of replacing corn by the various grains and pasture is discussed.

Rickets and paralysis in swine as affected by nutrition, G. BOHSTEDT, R. M. BETHKE, B. H. EDGINGTON, and W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 139-144, figs. 4).—In studying the nutritional factors influencing the production in winter of rickets and paralysis in swine, 10 lots of 8 41-lb. pigs were selected and fed for 160 days without access to soil or green feeds. The basal ration consisted of 70 per cent ground white corn, 15 per cent flour wheat middlings, 10.5 per cent linseed meal, 4 per cent blood meal, and 0.5 per cent salt until the pigs weighed 100 lbs., after which 5 per cent of the linseed meal was replaced by corn.

The results showed the necessity of supplementing the basal ration with both minerals and vitamins for the production of maximum growth and the prevention of rickets or paralysis. The addition of 1 per cent of cod liver and 2 per cent of precipitated bone flour produced the most uniform and rapid gains, and none of the pigs receiving these supplements became lame. Cod liver oil alone produced just as rapid growth, but 1 pig died and 4 others were only fairly thrifty or stunted. Five of the pigs receiving precipitated bone flour with aerated cod liver oil were only fairly thrifty or stunted. In the lots receiving the basal ration alone or with mineral supplements of 2 per cent of calcium carbonate, disodium phosphate, or precipitated bone flour, the gains made were only about half or less than half as rapid as when the mineral and vitamin supplements were furnished, and from 4 to 5 pigs died from each of these lots during the experiment. The gains were slightly better with the supplement of 2 per cent casein or 2 per cent precipitated bone flour, but 5 pigs died from the former and 2 from the latter lot, while none were very thrifty. Blood meal tended to hasten the development of rickets, as a lot receiving the basal ration without blood meal did better than the control lot. Precipitated bone flour, though proving valuable as a source of minerals, produced a mottling of the kidneys.

A simple mineral mixture for fattening pigs, J. C. GRIMES and W. D. SALMON (*Alabama Sta. Bul.* 222 (1924), pp. 10, figs. 2).—The results are given of two experiments in determining the value of a mineral mixture of equal

parts by weight of charcoal, marble dust, and salt for pigs when self-fed in dry lot a ration of 2 parts of ground corn and 1 part of peanut meal (hulls included). The first experiment was conducted with pigs averaging 73 lbs. in weight at the start and lasted for a period of 106 days. The average daily gains of the lot receiving the mineral mixture were 0.93 lb. as compared with 0.46 lb. by the lot receiving no minerals. A total of 415 lbs. of feed, including minerals, was required per 100 lbs. of gain by the former lot and 572 lbs. by the latter.

Similar results were obtained in the second experiment, which lasted 74 days. The pigs at the start were slightly smaller, averaging 57 lbs. The average daily gains made were 1.36 lbs. by the lot receiving minerals and 0.97 lb. when no minerals were fed. Three hundred and eighty lbs. of feed were required per 100 lbs. of gain by the former lot and 437 lbs. by the latter. The hogs receiving minerals were consistently more thrifty and in better condition during both of the experiments. None were crippled in shipping to market as compared with 2 receiving broken legs in the second test from the nonmineral lot, while only 3 of the 9 were able to stand after reaching market.

Swine judging, R. T. SMITH (*Washington Col. Sta. Pop. Bul.* 130 (1924), pp. 3-27, figs. 21).—The general principles of judging breeding and fat types of swine are discussed.

Photographing pigs with the aid of the "focus frame," G. BOHSTEDT (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 154-156, figs. 2).—The use of a series of bottomless stalls is suggested for photographing pigs. The camera is focused on the pigs, the stalls raised by pulleys, and the camera snapped.

[Poultry investigations at the Kansas Station] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 103-106, 107-116, 127, 128).—The results of the following experiments in poultry production are briefly reported:

Improving mongrel flocks through selected standardbred cockerels.—A comparison of the egg production of three generations of birds graded up by matings of mongrel hens with purebred White Orpingtons, White Wyandottes, and Single Comb Rhode Island Reds indicated marked improvement as a result of the Wyandotte and Rhode Island Red matings, but the White Orpington matings showed a decline in egg production, as did also the mongrels.

The feeding value of milo, cane, kafir, and mixed feed for pullets.—The records of the egg production, fertility, and hatching percentages are given for groups of pullets raised on the same rations as their dams received. A group on ground cane, with 25 per cent of meat scrap as the mash and whole cane seed as the scratch feed, was very backward in egg production and maturity.

Poultry flock management.—In a study of flock management, pullets were confined in one-half of a laying house, while hens in the other side were allowed range. The hens averaged 68.7 eggs per bird and the pullets 93.7 eggs during the first 8 months of the laying year. The eggs of the hens which were set proved to be 95 per cent fertile and 79 per cent hatched.

Incubation studies.—In a study of the effect of freezing the comb and wattles of cockerels on the reproductive organs, it was found that the testicles of one weighed 3 gm. as compared with 15 gm. for the testicles of another cockerel not having its comb and wattles frozen. No difference in fertility of another cockerel resulted after its comb had been frozen.

The calcium metabolism of the growing chick was studied by making analyses of the shells and contents of eggs subjected to varying periods of incubation and other treatments. The effects of various factors on hatching were studied by exposing trays of eggs to sunlight 15 minutes daily, to ultra-

violet light 5, 10, and 20 minutes daily, cooling 5 or 10 hours at one or two periods during incubation, and incubation at 95 and 105° F. during the first 3 days as compared with 101° during the first week. The hatching results are tabulated but not discussed. In one experiment the hatchability was slightly reduced by cooling, while the results with ultraviolet light and sunshine in three experiments were not uniform. In one experiment the hatchability was 81.8 per cent with the preliminary incubation temperature of 95°, 67.5 per cent with a temperature of 101°, and 25 per cent when a temperature of 105° was employed during the first 3 days of incubation.

The effect of inadequate rations on the production and hatchability of eggs.—The egg production, fertility, and hatchability of seven pens of 10 White Leghorn hens receiving rations varying in their vitamin content and other constituents are tabulated. The fertility of the eggs was 92 per cent or above in all but one pen, which received a ration containing no green feed and low in vitamins B and C, in which case the hatching percentage was 82 per cent. The egg production was very low in this pen, and the hatchability of the fertile eggs was only 46 per cent. A 17 per cent hatchability was obtained in the eggs from a pen receiving a ration low in vitamins A, C, and D.

Relation of vitamin content of feed and of the use of light to immunity to roup and the production and hatchability of eggs.—Six pens of White Leghorn pullets were fed on rations containing various amounts of the different vitamins with and without sun or ultraviolet light. The lack of vitamins A and B resulted in a heavy mortality of the chicks hatched, due to nutritional disease or beriberi, but none of the hens died from a lack of vitamin C in 8 months. Five of the 12 hens receiving a ration low in minerals and without light died with lesions resembling rickets. This was probably due to a deficiency of vitamin D, since the disease did not develop in another pen receiving the same ration, with exposure to ultraviolet light. The egg production and hatching percentages were much greater in the pens receiving ultraviolet light or sunlight.

Chemical analyses of the blood of the fowls of the different lots showed no regular differences in the total nitrogen, urea, or sugar content, but the eggs of the lots receiving a complete diet with light contained more calcium and phosphorus.

[**Poultry experiments at the Kentucky Station**] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 46-48*).—The results of the year's investigations with poultry are briefly noted, portions of which have been abstracted from more complete accounts in other places.

H-ion concentration and total alkalinity of the white and yolk of hen eggs.—This study has shown a rather constant pH value for the yolk of eggs, while the pH of the white increases with age. It is suggested that the white contains sodium bicarbonate, which is changed to normal carbonate with the escape of the free carbon dioxide from the egg.

The feeding of milk in various forms to laying hens.—The third year's results of this experiment were in substantial agreement with those of the first two years. The annual egg production on the different rations averaged for the three years 145 eggs on skim milk and a basic mash, 152 eggs on skim milk without mash, and 149 eggs when receiving the standard mash of equal parts of bran, shorts, ground oats, corn meal, and meat scrap. When the meat scrap of the mash was replaced by dried buttermilk, 179 eggs were laid, while another pen receiving meat scrap laid 178 eggs per hen.

A comparison of the common grains as supplements to skim milk for laying hens.—Four pens of 20 Barred Plymouth Rock pullets each were used for comparing various rations in addition to sour skim milk for laying hens. The fol-

lowing grain mixtures were fed to the different pens: Pen 1, shelled corn only; pen 2, shelled corn and oats 7:3; pen 3, shelled corn and wheat 7:3; and pen 4, shelled corn, oats, and wheat 6:2:2. The average annual egg productions on the rations were, respectively, 180, 161, 188, and 182 eggs. The winter production of the different lots ranked in the same order.

Poultry investigations, D. C. KENNARD and P. S. WHITE (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 7-8, pp. 107-117).—A progress report is given of continuations of the experiments previously noted (*E. S. R.*, 51, p. 471), as well as brief reports of the results of other experiments noted (*E. S. R.*, 48, p. 667; 51, p. 277).

In another experiment the hatchability of the eggs produced by pullets in the station flock has been increased from an average of 30 to 40 per cent to 60 to 70 per cent for the total eggs set by allowing range on blue grass or rye during the winter when the ground was not covered with snow and by the prevention of inbreeding in the flock. The feeds used in obtaining these results were cracked yellow corn and wheat as a scratch, while the mash contained ground corn, ground oats, wheat middlings, wheat bran, 10 per cent meat scrap, 10 per cent dried buttermilk, and 5 per cent alfalfa meal. A hot mash, chopped alfalfa, hot skim milk, and hot water were also supplied during the winter.

Value of certain grains for laying hens (*Montana Sta. Rpt. 1923*, p. 38).—In a comparison of wheat, oats, barley (hulled or hull-less), corn, and peas fed either alone or in combinations as grains for laying hens, it was found that oats and corn mixed in equal parts gave the best results. Wheat alone proved very satisfactory except for its cost.

Report of egg-laying contest for 1924, R. R. HANNAS and F. H. CLICKNER (*New Jersey Stas. Hints to Poultrymen*, 13 (1924), No. 3, pp. 4).—A preliminary report of the Bergen County international egg-laying contest and the second (yearling) year of the third Vineland international egg-laying and breeding contest.

A simple mineral mixture for chickens, D. C. KENNARD (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 159-164, figs. 3).—A mineral mixture is recommended for chickens consisting of 60 parts of fine ground raw bone meal, 20 parts of ground limestone, and 20 parts of sodium chloride. Its recommendation is based largely on the results of the investigations noted above.

Raising Easter broilers, D. C. KENNARD (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 165-168).—The production of Easter broilers is discussed. For this enterprise the birds must be hatched from 8 to 10 weeks before Easter in order that they attain the desired weight of from 1.5 to 2 lbs. They must be kept indoors, and proper feeding is especially important. In addition to the usual feeds, the mash should include 3 per cent of cod liver oil or egg yolk, and the chicks should receive buttermilk or skim milk and lettuce or cabbage. The cod liver oil should be omitted from the ration 2 weeks before marketing in order to avoid the production of a fishy flavor.

An automatic switch for poultry houses, C. M. FERGUSON (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 44-46, fig. 1).—A simple device for automatically turning the lights on in the poultry house is described. An alarm clock is used as a regulator.

DAIRY FARMING—DAIRYING

[Feeding experiments with dairy cattle at the Illinois Station] (*Illinois Sta. Rpt. 1923*, pp. 19, 20).—Preliminary results indicate that soy bean oil meal compares favorably with choice cottonseed meal in feeding value for milk

production, but soy bean straw was a relatively poor roughage for yearling dairy heifers because of its coarse, woody stems and low protein content.

In other experiments, soluble mineral salts appeared to be beneficial, while the feeding of bone meal *ad libitum* is not recommended because of the harmful effects of the accompanying large salt consumption.

In a study of the use of self-feeders, cows have tended to consume the proper feeds to meet their requirements through the entire gestation period, though marked individual and periodic differences were observed in the preference of animals for particular feeds. Corn was the most palatable concentrate.

[Feeding experiments with dairy cattle at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1923-24, pp. 99-101, 137, 138*).—In comparing ground kafir seed and corn chop for milk production, 8 cows were fed by the double reversal method. The basal ration consisted of alfalfa hay and cane silage. When receiving ground kafir in addition to the basal ration, the cows averaged slightly higher in body weight, but the difference is not significant. The milk and fat production was slightly lower on this ration than with the corn, but the decrease was only 4 per cent for milk and 3.1 per cent for fat. In another test three lots of 4 heifers were used in comparing corn, kafir, and cane seed as supplements to alfalfa hay for growing heifers. The gains in weight indicated a slight superiority of corn over kafir, but in height the reverse occurred. Cane seed produced the smallest gains in weight and height.

In two trials with 16 cows divided into four groups, the palatability of four grain mixtures was compared by determining the length of time required for the consumption of the ration. A mixture of 400 lbs. of wheat, 200 lbs. of bran, and 100 lbs. of oil meal proved the most palatable, followed in order by mixtures of 300 lbs. of wheat, 300 lbs. of corn, and 100 lbs. of oil meal; 300 lbs. of wheat, 200 lbs. of corn, 100 lbs. of bran, and 100 lbs. of oil meal; and 600 lbs. of wheat and 100 lbs. of oil meal. In another test a mixture of 5 parts of wheat to 1 of oil meal was refused by cows after they had eaten their regular grain and silage ration.

In continuing the study at the Colby Substation on the carrying capacity of pastures (*E. S. R., 49, p. 472*), 1.75 acres of Sudan grass pasture was found to furnish ample feed for 2 cows for 98 days in 1921, 58 days in 1922, and 101 days in 1923. This pasture also acted as a stimulant to milk production. In other experiments grain or silage was found to increase milk production when fed as a supplement to summer pasture.

[Experiments with dairy cattle at the Montana Station] (*Montana Sta. Rpt. 1923, pp. 20, 21, 49, fig. 1*).—The results of the following experiments are reported, some being continuations of those previously noted (*E. S. R., 49, p. 172; 50, p. 176*):

Sunflower silage for dairy cows, C. N. Arnett.—A 90-day comparison of the value of oat-and-pea silage with sunflower silage for milk production indicated practically no difference. The four cows on sunflower silage produced an average of 1.17 lbs. of butterfat per head daily as compared with 1.16 lbs. for the four cows receiving the oat-and-pea silage. The average daily ration of the two lots consisted of 33 lbs. of silage, 11.75 lbs. of alfalfa hay, and 9.5 lbs. of grain. The sunflower silage was calculated to cost \$1.47 per ton less than oat-and-pea silage.

Soiling compared with pasture for dairy cows, C. N. Arnett.—Cows required 0.1 acre more land per head for pasture than was required for the production of sufficient soiling crops. The group receiving the latter feed produced 1.75 lbs. more milk and 0.06 lb. more fat than the group on pasture. The pasture

was, however, more economical because of the cost of cutting and feeding the soiling crops.

Summer pasture for cows on irrigated land, D. HANSEN.—At the Huntley Substation irrigated pastures, especially seeded, have been found to carry per acre 1.5 to 2 cows giving a full milk flow for 4.5 months.

The relation between age, weight, and fat production in dairy cows, C. W. TURNER, A. C. RAGSDALE, and S. BRODY (*Missouri Sta. Bul.* 221 (1924), pp. 3-12, figs. 5).—These results have been essentially noted in two previous studies (E. S. R., 50, p. 578).

Factors affecting the percentage of fat in cows' milk, C. W. TURNER (*Missouri Sta. Bul.* 222 (1924), pp. 3-22 figs. 11).—The effects of various physiological factors and breed differences on the butterfat percentage of milk, as determined in earlier studies at this station and by other investigators, are briefly reviewed.

The metabolism of calcium, magnesium, phosphorus, and sulfur in dairy cows fed high and low protein rations, C. F. MONROE (*Jour. Dairy Sci.*, 7 (1924), No. 1, pp. 58-73).—This is another account of the study of the effect of high and low protein rations on the nitrogen, calcium, phosphorus, magnesium, and sulfur balances of dairy cows, previously noted (E. S. R., 51, p. 875).

The effect of gestation upon lactation in the dairy cow, A. C. RAGSDALE, C. W. TURNER, and S. BRODY (*Jour. Dairy Sci.*, 7 (1924), No. 1, pp. 24-30, figs. 2).—By tabulating from the Advanced Register of Guernsey Cattle the monthly milk production during lactation of nonpregnant cows and cows bred during the third and fourth months of lactation, it is shown that during the first 5 months of the lactation period the monthly decline of the two groups was similar, but the decrease was more rapid in the pregnant cows from the fifth to the twelfth month.

A second method of studying the effect of gestation on lactation consisted of grouping the cows at the eighth, tenth, eleventh, and twelfth months of lactation according to the stage of pregnancy. A rapid decline in milk production was evident after the fifth month of gestation. Composite data indicate a reduction of from 480 to 800 lbs. in the milk production due to pregnancy in the latter part of the lactation period. This reduction is due to the necessity of properly nourishing the fetus, and "it is believed that the reduction in milk flow of the lactating dairy cow gives a better picture of the nutrients required to develop the bovine fetus than does the dry matter content of the fetus expressed in pounds of milk."

A study of the cattle of the Campine region [trans. title] (*Min. Agr. [Belgium], Serv. Élevage Pub.* 4 (1923), pp. 88, pls. 16, figs. 3).—This deals with the characteristics of Campine cattle and the conditions prevailing in their native region in northern Belgium.

The characteristics of the Red German cattle [trans. title], V. O. SVIRENKO (*Izv. Opytn. Dona i Sev. Kavkaza (Jour. Agr. Research Don and North Caucasus)* No. 1 (1922), pp. 40-55).—This deals with the milk production and feed requirements of Red German cattle as determined from six years' observations of a herd at the Rostov-Nakhichevan Agricultural Research Station.

The cow tester's handbook, J. C. McDOWELL (*U. S. Dept. Agr., Misc. Circ.* 26 (1924), pp. II+22, figs. 6).—A handbook setting forth briefly the duties of cow testers.

Milk [trans. title], C. PORCHER (*Min. Agr. [Argentina], Secc. Propaganda e Informes Circ.* 317 (1924), pp. 199, figs. 17).—This consists of a series of 20 lectures on the chemical and physiological properties of milk, dealing as well with the principles involved in its production and handling, and the manufacture of dairy products.

Contribution to the study of the rising of cream on milk, A. GRÜNDLER (*Beitrag zur Kenntnis der Aufrahmung der Milch. Inaug. Diss., Univ. Zurich, 1923, pp. 29, fig. 1*).—The results of a study of the factors influencing the rate of the rising of cream are given. Samples of milk were found to show differences in the fat content at different levels in the can within 20 to 30 minutes after milking, but when the milk was moved about the mixing prevented the rising of the cream. Cream rose much more rapidly when the milk was cooled and when the fat globules were large.

[Experiments in dairying at the Illinois Station] (*Illinois Sta. Rpt. 1923, pp. 19, 20*).—The milking machine, unless properly sterilized, has been found to be an important source of milk contamination. Bacterial action in plain bulk and condensed milk kept too long produces off flavors which have a detrimental effect on the ice cream made from them.

Standardizing the acidity of the cream and adding salt have been found most satisfactory for reducing the fat loss in buttermilk. In studies of the factors affecting quality in ice cream, homogenization was found to improve texture and resistance and reduce the amount of milk solids required. The percentage of overrun depends on the composition and method of preparation and is directly associated with the texture.

Effect of the process of manufacture on the germ content of bulk condensed milk, H. A. RUEHE (*New York Cornell Sta. Mem. 76 (1924), pp. 3-18, figs. 3*).—The bacterial content of milk during the various processes of condensing has been determined in studies at the University of Illinois, and the results are herein reported.

The milk used was purchased from farmers, skimmed to an approximate 2.3 per cent fat content, heated to 150° F. by live steam, and held at this temperature for 15 minutes, after which it was boiled under a vacuum pan at a temperature of 128 to 140° for 1.5 to 2 hours. After being concentrated from 3.5 to 1 part, it was superheated to 180 to 186° until properly thickened, after which it was cooled. Bacterial counts were made of the raw milk and of the processed milk after preheating, concentration, and superheating. Some of the samples were modified by skimming, by the addition of some concentrated milk, and by changes in other conditions. The equipment was carefully cleaned between batches much as would be expected under commercial operations.

The results showed that the processes through which milk goes in being condensed tend to lower the bacterial content of the finished product, the maximum, minimum, and average final counts being, respectively, 36,400, 480, and 6,289 bacteria per cubic centimeter, though the initial milk had counts in some cases of over 100,000,000. High bacterial counts in condensed milk are suggested as due to contamination after manufacturing or to improper storing.

Ice cream investigations (Kansas Sta. Bien. Rpt. 1923-24, pp. 101-103).—In viscosity studies with ice cream, aging in separate cans resulted in differences in each can in the viscosity and yield of the frozen product. The reason for this was not determined, as the fat, total solids, and acidity were similar. It has been found that there is an optimum viscosity for maximum yield. With a low viscosity the mix is unable to retain sufficient air and lacks smoothness of texture. Excessive viscosity prevents the incorporation of air, and low yields result. This study is being continued for further determination of the factors responsible for viscosity.

Report of the delegates from Argentina to the World's Dairy Congress held in Washington, Philadelphia, and Syracuse [trans. title], A. PIMENTEL, G. M. CASARES, R. H. PEARSON, JR., and E. M. QUINTANA (*Min. Agr. [Argentina], Secc. Propaganda e Informes Circ. 313 (1924), pp. 303, pls. 3, figs. 165*).—This

includes descriptions of educational institutions and exhibits and practical dairy conditions as observed in this country, as well as an account of the congress (E. S. R., 49, p. 601).

VETERINARY MEDICINE

Veterinary hygiene.—I, **Hygiene of productive farm animals**, M. KLIMMER (*Veterinärhygiene.—I, Gesundheitspflege der Landwirtschaftlichen Nutztiere*. Berlin: Paul Parey, 1924, 4. ed., rev. and enl., vol. 1, pp. XI+489, figs. 449).—A new revised and enlarged edition of volume 1 of this work (E. S. R., 46, p. 178; 49, p. 278).

First aid to animals, J. L. LEONARD (*New York and London: Harper & Bros.*, 1924, pp. X+396, figs. 37).—This is a practical account.

The influence of nutrition on the incidence of disease, J. B. ORR (*Vet. Rec.*, 4 (1924), Nos. 45, pp. 943-947; 46, pp. 963-967).—The author calls attention to the urgent need for research to determine the requirements for all the constituents of food which are known to be essential, and the connection between specific defects and the correlated pathological phenomena. A discussion on the paper is included (pp. 963-967).

Prevention of disease, D. BRUCE (*Nature [London]*, 114 (1924), No. 2858, Sup., pp. 213-227; also in *Science*, 60 (1924), No. 1545, pp. 109-124).—In this presidential address, delivered at the annual meeting of the British Association for the Advancement of Science at Toronto on August 6, 1924, the history and mode of prevention of certain types of diseases are summarized.

Among the infectious diseases, Malta fever, typhoid fever, tetanus and diphtheria, and tuberculosis were selected as bacterial diseases illustrating prevention by finding and eliminating the sources of the disease, by securing greater resistance through bringing about a mild attack of the disease, by neutralizing the toxins of the invading bacilli through the introduction of anti-toxin, and by improvement of hygienic conditions and the segregation of the more infective types, respectively. Of the protozoal diseases the tsetse-fly disease, sleeping sickness, yellow fever, and malaria are discussed as illustrating diseases which can be eliminated most satisfactorily by the removal of the carriers of the infection. A final group under infectious diseases is called the undetermined group in which the parasite is unknown or doubtful. Under this group are discussed trench fever, typhus fever, and Rocky Mountain fever, the prevention of which is best effected by the removal of the carrier. Brief mention is made of several diseases of which the most valuable method of prevention seems to be the use of virulent serum or toxin-antitoxin mixtures. Included in this group are rinderpest, foot-and-mouth disease, and scarlet fever.

Dietary deficiency diseases, particularly rickets, and diseases referable to the ductless glands are also discussed briefly.

Stock-poisoning plants of the range, C. D. MARSH (*U. S. Dept. Agr. Bul.* 1245 (1924), pp. 36, pls. 43, figs. 30).—This is a revision of and supersedes Bulletin 575, previously noted (E. S. R., 39, p. 386).

On the effects of castration upon the thyroid gland, hypophysis, thymus, and adrenals in the albino rat [trans. title], S. MATSUBA (*Jour. Japan. Soc. Vet. Sci.*, 3 (1924), No. 3, pp. 169-260, pls. 4).—This is a report of studies based upon 255 male rats, varying from new born to 300 days of age.

The present status of the parasitic nematode family Ascaridae, C. W. STILES and G. BROWN (*Pub. Health Rpts. [U. S.]*, 39 (1924), No. 32, pp. 1957-1962).—The inaccessibility of the literature on the Ascaridae has led the authors

to prepare a key which gives the more essential characters of the present genera of the family, including five reported as parasitic in man, namely, *Ascaris*, *Toxocara*=*Belascaris*, *Toxascaris*, *Lagochilascaris*, and *Fusaria sens. lat.*

Diseases of farm animals (*Kansas Sta. Bien. Rpt. 1923-24, pp. 120-124*).—In investigations of abortion disease and of blackleg, the aggressive strength of filtrates produced from avirulent strains of *Clostridium chauvei* was found to be as high as that of filtrates produced from virulent strains (E. S. R., 49, p. 680). This made it possible to use avirulent strains in the production of blackleg filtrate, which insures the use of a larger number of strains and the production of a more highly polyvalent product than if only virulent strains were used.

In reporting upon poultry disease investigations the areas of localization found in examinations made of the organs of 33 chickens affected with tuberculosis are shown in tabular form. Two cases of infectious enterohepatitis (blackhead) in chicks were diagnosed. Eleven cases of gizzard worm infestation were diagnosed, in contrast to one the preceding year. Arecoline hydrobromide was administered in a few cases of tapeworm infestation and found to be very efficient, but more work needs to be carried on before it can be recommended to the layman. Its correct dosage for fowls was not determined, but 0.1 grain seems to be about the therapeutic dose. Two cases of vent gleet reported showed severe infection of the ovaries, and both gave pure cultures of *B. pullorum*.

Some cultural characters of *Bacillus abortus* (Bang) with special reference to CO₂ requirements, T. SMITH (*Jour. Expt. Med.*, 40 (1924), No. 2, pp. 219-232).—The investigation reported is chiefly a study of the carbon dioxide requirements of *B. abortus* as determined by the growth of freshly isolated strains in varying dilutions in sealed agar tubes containing different concentrations of carbon dioxide.

It was first shown that some oxygen is necessary for the growth of the organism, for in sealed tubes growth became stationary after a time and was renewed on opening the tube. In the absence of carbon dioxide in a sealed tube the growth of the organism was rapidly inhibited. In tubes containing carbon dioxide in varying concentrations of from 0.1 to 10 per cent, growth was rapid and vigorous. In mixtures of nitrogen and air and hydrogen and air no growth took place until carbon dioxide was admitted to the extent of 2 per cent by volume. In mixtures containing 90 per cent of carbon dioxide growth was retarded and in 100 per cent practically entirely eliminated, while in an atmosphere containing 10 per cent of carbon dioxide and 90 per cent of nitrogen or hydrogen growth was luxuriant.

The effect of carbon dioxide is considered not to be due to alterations in the H-ion concentration, for it was demonstrated that growth of *B. abortus* takes place readily in suitable media varying in H-ion concentration from pH 6 to 8. The growth of *B. abortus* for a time in sealed tubes is explained tentatively by the production of carbon dioxide by the transferred bacteria and the retention of the carbon dioxide by the seal.

The vaccinal immunization of guinea pigs against *Bacterium abortus* (Bang) infection, I. F. HUDDLESON (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 63-66).—In this progress report on the study of infectious abortion, data are presented showing that immunity to *B. abortus* can be induced in guinea pigs by the subcutaneous injection of an avirulent strain of the organism.

In addition to a preliminary experiment of limited value on account of the absence of controls, the evidence includes two experiments involving in one

case 10 female guinea pigs and 3 controls and in the other 10 male guinea pigs and 3 controls. The immunization in all cases consisted in a single subcutaneous injection in the abdominal region of 0.5 cc. of a turbidity 5 (McFarland nephelometer) of a living suspension of the nonvirulent culture, the subsequent exposure, and the feeding daily for 10 days of from 3 to 5 48-hour agar slants of a virulent strain.

The animals in the first group were autopsied about 9 weeks after the beginning of the experiment. The organs of the immunized animals and two of the controls showed no evidence of infection, while the third control had characteristic lesions in the spleen, liver, and left costal cartilage from which *B. abortus* was isolated in pure culture. In the second group the immunized animals again showed no signs of infection, while all of the controls showed marked signs of infection and their diseased organs yielded *B. abortus* in pure culture. All but one of the immunized animals gained in weight during the experiment, and all of the controls lost in weight. The duration of the immunity thus secured has not yet been determined.

[**Infectious abortion in mares and in cows**] (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 41, 42*).—A brief reference is made to the use of vaccine in combating this disease in mares, and to its occurrence in cows.

Sensitivity to anthrax and the nature of antianthrax immunity [trans. title], A. ZIRONI (*Bol. Ist. Sieroter. Milan., 3 (1924), No. 3, pp. 181-189*).—This is a discussion of the Besredka theory of cutaneous immunity in anthrax (E. S. R., 44, p. 877). In the author's opinion the susceptibility of the skin to anthrax in contrast to other organs is caused by a deficiency in the defensive and bactericidal power of the cells of the epidermis. The anthrax bacilli are not destroyed in the skin, but multiply and become modified so that they acquire resistance against the normal lytic and phagocytic power of the intracellular fluids. In guinea pigs and rabbits immunized against anthrax a state of allergy is set up, and the cutaneous or subcutaneous injection of living anthrax bacilli is followed by a marked reaction which has the effect of concentrating in the skin those substances which under normal circumstances circulate through the other organs.

Production of antibodies in cutaneous antianthrax immunity [trans. title], A. GRATIA (*Compt. Rend. Soc. Biol. [Paris], 91 (1924), No. 28, pp. 795-797*).—The author explains cutaneous immunity to anthrax in somewhat the same way as noted in the above paper. In his opinion, the better success obtained in vaccination by the cutaneous than by the subcutaneous route is that the skin is favorable to the multiplication and encapsulation of the bacteria which impregnate the tissues with toxic products. The animal thus vaccinated responds not only with agglutinins and allergins but with antiaggressins. On the other hand, the bacteria which are introduced subcutaneously are rapidly phagocytized and do not have time to become encapsulated or to liberate aggressins. The body responds with the formation of agglutinins but not antiaggressins, and is consequently not effectively immunized.

Toxico-immunologic and serologic relationship of *B. botulinus*, type C, and *B. parobotulinus*, "Seddon," XXII, W. PFENNINGER (*Jour. Infect. Diseases, 35 (1924), No. 4, pp. 347-352, fig. 1*).—Pure strains of *Bacillus botulinus* type C isolated by Bengtson (E. S. R., 47, p. 258) and by Graham and Boughton (E. S. R., 50, p. 383) and of *B. parobotulinus* of Seddon (E. S. R., 48, p. 678) have been compared in toxin-antitoxin and in agglutination tests.

The C type toxin was neutralized only by C type antitoxin, while the parobotulinus toxin was neutralized by both its own and type C antitoxin, but not by types A and B antitoxin. Antiserums prepared from two of the type C

strains agglutinated in varying degrees with all of the C type antigens, but not with the parabolulinus antigen even in a dilution of 1:20. The parabolulinus antiserum agglutinated five of the type C strains.

These preliminary tests are thought to indicate that the Seddon parabolulinus strain and the C type botulinus strains belong to different serologic groups which can be distinguished from each other by the agglutination test.

The rôle of staphylococci in epizootic lymphangitis [trans. title], A. BIGOR and H. VELU (*Rec. Méd. Vét.*, 100 (1924), No. 12, pp. 280-287).—It is pointed out that staphylococci are constantly associated with the *Cryptococcus* in all open lesions of epizootic lymphangitis. Their rôle is far from being negligible, it being easy to demonstrate by the use of antistaphylococcic vaccines, and the authors are led to conclude that epizootic lymphangitis is due to a mixed infection of *Cryptococcus* and *Staphylococcus*.

Experimental contribution to the question of sensitiveness to tuberculin and the antigenic properties of tuberculin [trans. title], H. J. MARKERT (*Ztschr. Immunitätsf. u. Expt. Ther.*, 40 (1924), No. 1-2, pp. 172-178).—The author has repeated the experiments of Seligmann and Klopstock (E. S. R., 47, p. 386) in attempts to determine whether a specific sensitiveness to old tuberculin can be induced in healthy guinea pigs by repeated subcutaneous injections, and has come to the conclusion that this is not possible. The inflammation and infiltration occurring after a time at the site of injection are considered to be due not to sensitiveness to tuberculin but to the proteins or protein-like substances in tuberculin.

Avian tuberculosis (*Illinois Sta. Rpt. 1923*, p. 17).—From preliminary studies it is noted that while avian tuberculosis in swine appears to be but slightly communicable to other animals, some avian strains are transmitted readily from poultry to swine and back to poultry. It is thought that English sparrows in the vicinity of infected chickens sometimes contract tuberculosis.

[**Studies with sheep by the Montana Station veterinary department**], H. WELCH (*Montana Sta. Rpt. 1923*, pp. 38, 39).—Three rather extensive outbreaks of necrobacillosis in sheep occurred during the spring of 1923, most of the infected lambs dying when about five days old. The losses were checked in all three outbreaks by disinfecting the freshly severed cord with tincture of iodine or other reliable disinfectant.

Infectious abortion of ewes discovered in five bands in different parts of the State in 1923 was found to be due to a spirillum, or vibrio organism, as previously noted (E. S. R., 51, p. 785). A simple blood test has been devised whereby blood from aborting ewes can be examined in the laboratory and the disease thus distinguished from accidental abortion due to other causes.

Pernicious anemia of the sheep and of the goat [trans. title], A. DONATIEN and F. LESTOQUARD (*Rec. Méd. Vét.*, 100 (1924), No. 14, pp. 386-391, figs. 2).—This is a report of studies, at the Pasteur Institute of Algeria, of a disease of the sheep and goat due to a filterable virus which is transmissible to the sheep, goat, horse, ass, and calf. It is characterized by a progressive anemia, resulting in cachexia and death. Lesions of the suprarenal capsules predominated in its pathology. The disease is said to offer a striking analogy to the pernicious anemia of the horse, described by Carré and Vallée.

Treatment for stomach worms of sheep, D. S. BELL (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 9-10, pp. 173, 174).—Formulas are given for the copper sulfate and the nicotine sulfate treatments, with directions for dosing.

[**Infectious abortion in swine**] (*Illinois Sta. Rpt. 1923*, p. 18).—In this progress report, continuing the study of infectious abortion in swine (E. S. R., 49, p. 380), it is noted briefly that gilts may be exposed to abortion infection

up to 4 months of age with little danger of their becoming permanent abortion carriers. It is also reported that examination of the bulbo-urethral glands and seminal vesicles of actively-breeding boars has shown the presence in these organs of abortion bacilli, indicating the possibility of infection from this source.

Infectious abortion of mares in Argentina and its control through an active vaccine [trans. title], F. RUPPERT and H. PORCEL (*Deut. Tierärztl. Wchnschr.*, 32 (1924), No. 33, pp. 475-477).—In two lots of mares in which abortions were occurring as the result of infection with *Bacillus paratyphosus abortus equi*, active immunization with an emulsion of attenuated bacilli was practiced. In the first lot of 29 mares there were 19 cases of abortion before vaccination and none after, and in the second of 23 mares 5 cases of abortion before and 1 after, the 1 case of abortion occurring two days after the vaccination. The successful results obtained as compared with the many failures reported in the literature are attributed to the fact that the vaccine was not administered until late in pregnancy.

A contribution to the knowledge of infectious anemia of the horse as observed in South Africa [trans. title], G. VAN DE W. DE KOCK (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, 27 (1924), No. 1, pp. 30-46, figs. 2).—The data here presented have been noted from another source (E. S. R., 52, p. 85).

Prevention and control of poultry diseases, L. D. BUSHNELL and W. R. HINSHAW (*Kansas Sta. Circ.* 106 (1924), pp. 78, figs. 25).—A discussion of the essentials of poultry hygiene, etc. (pp. 2-15), in which particular attention is given to the vitamin requirements of the diet, is followed by a detailed practical account of poultry diseases and means for combating them. Much useful information is given in an appendix.

[Bacillary white diarrhea] (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 124-126).—In this progress report on work on white diarrhea or *Salmonella pullora* infection, it is noted that in 2,152 adult fowls in 90 flocks tested by the agglutination test, 825 reactors were found. Infection with *S. pullora* was identified on post-mortem examination in 68 cases of bacillary white diarrhea among 228 chicks, 11 of acute adult *S. pullora* infection among 21 fowls, and 23 of ovarian infection among 28 fowls.

In the course of the agglutination studies various difficulties were encountered, including the appearance of fatlike suspensions which prevented accurate readings, partial agglutination in the sera of many apparently normal fowls, and contamination of blood samples en route. The finding of a large number of reactors in Barred Plymouth Rocks of a particular strain is thought to indicate that the disease is introduced into flocks by purchase of particularly reactive strains. The post-mortem examination of birds known to be reactors has shown typical ovarian lesions in all cases, with generalized lesions in one case.

Control of bacillary white diarrhoea, 1923-1924, G. E. GAGE and O. S. FLINT (*Massachusetts Sta. Control Ser. Bul.* 27 (1924), pp. 8).—This bulletin, which reports upon work conducted in continuation of that previously noted (E. S. R., 50, p. 383), gives the details of work completed during the testing season ended July 1, 1924, together with a summary of the improvement effected since the establishment of the testing work. During the season, 59,635 breeding birds were tested, this being 26,033 more than during the same period the preceding year. As shown by the records of the flocks tested, the infection has been reduced over the preceding year by about 60 per cent. Thirty-eight white diarrhea-free flocks were established, and nearly 90 per cent of the chicks hatched from eggs from diarrhea-free flocks lived.

[**Chicken cholera studies**] (*Kansas Sta. Bien. Rpt. 1923-24*, pp. 126, 127).—The complement fixation reaction has been found to be a reliable test for immunity to chicken cholera. Attempts to increase the immunity to the chicken cholera organism, *Pasteurella avicida*, by the intravenous injection of 1 cc. of normal inactivated horse serum one week after vaccination gave an increased complement fixing antibody content of the serum of both vaccinated and non-vaccinated birds, but did not increase the immunity.

In experiments with killed cultures, several virulent strains of *P. avicida* were pooled and heated at 60° C. for 1 hour and injected subcutaneously in 2.5 cc. doses in 12 fowls. One week later these fowls and 16 nonvaccinated controls were given 5 M. L. D. of a virulent culture of *P. avicida*. All of the controls and only 3 of the vaccinated birds died.

[**Roup and chicken-pox vaccine**] (*Kentucky Sta. Rpt. 1923*, pt. 1, p. 51).—It is stated that the best results have been obtained with roup and chicken-pox vaccine when the flocks are vaccinated after the appearance of the disease with an autogenous vaccine or one prepared from material secured from the flock to be vaccinated.

The tuberculosis of domesticated fowl [trans. title], A. EBER (*Ztschr. Infektionskrank. u. Hyg. Haustiere*, 27 (1924), No. 1, pp. 1-19).—This is a report on the post-mortem findings in 38 lots of fowls, of which 19 lots were hens, 4 were turkeys, 1 the peacock, 5 pheasants, 8 pigeons, and 1 the duck.

Parasitological investigations (*Kansas Sta. Bien. Rpt. 1923-24*, pp. 88, 89).—Studies were made of the roundworm parasite of chickens (*Ascaridia perspicillum*), an account of which has been noted (*E. S. R.*, 51, p. 385). Data on the embryology of parasitic worms are also briefly reported.

RURAL ENGINEERING

Progress in agricultural engineering at the stations, R. W. TRULLINGER (*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas.*, 1922, pp. 95-111).—The evolution and progress of research in agricultural engineering at the stations are briefly reviewed, and suggestions are made as to lines and methods along which this work may be further developed. A bibliography of 86 references to works bearing on the subject is appended.

[**Agricultural engineering studies at the Montana Station**], H. E. MURDOCK (*Montana Sta. Rpt. 1923*, pp. 12-15, figs. 4).—Data are briefly presented on the treatment of fence posts, ditching with dynamite to drain land, and a combination drainage and irrigation system.

Surface water supply of Hudson Bay and upper Mississippi River basins, 1921 (*U. S. Geol. Survey, Water-Supply Paper 525* (1924) pp. V+191, pls. 2).—This report, prepared in cooperation with the States of Minnesota, Wisconsin, Iowa, and Illinois, presents the results of measurements of flow made on streams in the Hudson Bay and upper Mississippi River basins during the year ended September 30, 1921.

Drainage construction on Newlands Reclamation Project, A. W. WALKER (*Engin. News-Rec.*, 93 (1924), No. 10, pp. 382-386, figs. 8).—The conditions under which over 150 miles of drain were built on the Newlands Reclamation Project are described, and the methods adopted to obtain economy and speed in construction are summarized. It is stated that the serious water-logging of the farm lands by irrigation seepage water necessitated the rapid construction of a comprehensive drainage system.

Data on the results obtained from the drains are reported, showing a general lowering of the ground water. Aside from this, the outstanding benefit

is the furnishing of an adequate outlet for surface and soil drainage waters. Analyses of soil samples showed conclusively the effect of drainage in reducing the soil alkalinity.

A comparison of the composition of the drainage water with that of the irrigation water showed that when the drains were discharging freely, as during June and July, the drainage water carried about ten times as much salts as the irrigation water. Analyses covering the entire year showed that the proportion of calcium in the drainage water was much lower than in the irrigation water. In fact, the actual lime content of the drainage water was generally lower than that of the irrigation water. This is taken to indicate that there is a marked absorption of lime from the irrigation water, accompanied by a displacement of soda from the soil.

[Removal of an apple orchard at the Kansas Station] (*Kansas Sta. Bien. Rpt. 1923-24*, p. 62).—It was found that the removal of a mature apple orchard, consisting of about 35 trees to the acre averaging 12 in. in diameter, in dry clay loam soil is an expensive procedure. On the basis of time required the cost per tree was \$2.10 and per acre \$73.43.

Public Roads, [November, 1924] (*U. S. Dept. Agr., Public Roads*, 5 (1924), No. 9, pp. 13, figs. 21).—This number of this periodical contains the usual data on road-material tests and inspection news and status of Federal-aid highway construction as of October 31, 1924, together with the following articles:

Static Load Tests on Pavement Slabs, by J. T. Thompson (see below); The Constitutionality of Motor Vehicle License Fees and the Gasoline Tax, by H. R. Trumbower; and Status of the Motor Truck Impact Tests of the Bureau of Public Roads, by C. A. Hogentogler.

Static load tests on pavement slabs, J. T. THOMPSON (*U. S. Dept. Agr., Public Roads*, 5 (1924), No. 9, pp. 1-6, figs. 13).—The results of tests of pavement slabs to determine the influence of static loads are reported.

It was found that the static resistance of both the corners and the edges of rigid slabs is affected by the nature of the subgrade, the more resistant the subgrade being to load the greater being the resistance of the slab, and vice versa. The resistance of rigid slabs to static loads did not vary with the square of the depth but as some power greater than 1 and less than 2, the average value being about 1.75, and being higher for slabs on wet subgrades and lower for those on dry subgrades. The corners and edges of concrete slabs offered about the same degree of resistance to static loads.

The presence of mesh reinforcement did not increase the load-carrying capacity of concrete slabs, but did cause a tendency to hold together and resist complete failure after initial or elastic failure had taken place. The bituminous topping laid on rigid slabs did not increase their resistance to static load. Bituminous slabs showed no slab strength at ordinary summer temperatures.

The relation between durability and chemical composition in wood, L. F. HAWLEY, L. C. FLECK, and C. A. RICHARDS (*Indus. and Engin. Chem.*, 16 (1924), No. 7, pp. 699, 700).—In a contribution from the Forest Service and Bureau of Plant Industry, U. S. D. A., studies of the apparent relationship between the chemical composition and durability of woods, as indicated by the toxicity of the extracts made from several durable woods, are reported. *Fomes annosus* was used throughout as the indicator for toxicity tests.

The results showed that the hot water extracts are all more toxic than the cold water extracts of the same materials. In all cases the sapwood extract was less toxic than the corresponding heartwood extract. It is concluded that the relative resistance to decay of the several woods examined can be largely explained by the toxicity of their extracts. The hot water extracts of the

heartwood of the less durable woods, such as red oak and red alder, retarded the growth of the fungus less than any of the similar extracts of the more durable species. The cold water heartwood extracts of these species were less toxic than any of the others except yew and white oak, the toxicity of which was practically the same as that of the red oak.

It is concluded that the figures obtained on the relative toxicity of the extracts to *F. annosus* are in close accord with what is known of the relative durability of the species and forms of wood studied.

Summary of the national farm power survey, C. D. KINSMAN (*Agr. Engin.*, 5 (1924), No. 8, pp. 176-179, 173, figs. 15).—In a contribution from the U. S. D. A. Bureau of Public Roads a summary is given of data obtained on the number, distribution, sizes, and types of farms; the amounts and kinds of livestock kept; the kinds and yields of crops raised; the number and distribution of work animals; various kinds of mechanical power units; and the number of agricultural workers both regularly and intermittently employed.

The data indicate that more primary power is used by agriculture at the present time than in any other industry with the exception of transportation. All manufacturing industries combined have only about half as much power available as agriculture. The cost of power on farms in the United States at present values is about \$3,000,000,000 annually. However, by the use of this power, together with modern labor-saving equipment, the American farmer is enabled to increase his production per man by at least three times more than was possible with other methods 75 years ago. The data also show that an extremely close relationship exists between the amount of machinery used per worker and the volume of production. The amount of primary horsepower per worker has increased from about 1.5 in 1850 to 4.6 at the present time.

There is expended annually on farms about 30,000,000,000 hours of human energy, which is distributed approximately as follows: 45 per cent on field work, 35 per cent on livestock operation, 15 per cent on hauling, and 10 per cent on the care of equipment. Approximately half of the power used on farms is for field work, plowing being the largest item in this group. Hauling represents about 22 per cent of the total power, heavy stationary work 17 per cent, and light stationary work 11 per cent.

The variations in the amount of power per worker, as indicated by the data, are said to be due almost entirely to the size of the machine units in use in the different States, while the amounts of power utilized per farm are due largely to the type of farming followed, the size of farm, the machinery used per worker, the type of soil, and the climatic conditions.

It is stated that one of the most serious problems encountered in the displacement of horses by tractor power is the fact that the tractor as it is now designed does not entirely displace horse power on most farms, and the horses that are necessarily kept do only about half as much work as before the tractor was purchased.

Saving gasoline and increasing mileage by proper carburetor adjustment, G. W. JONES and A. A. STRAUB (*U. S. Dept. Int., Bur. Mines Serial 2616* (1924), pp. 9, pl. 1).—Studies conducted by the U. S. Bureau of Mines on high test and low test gasolines and a benzol-gasoline blend in order to determine the effect on carburetor adjustment of different fuels are reported.

The results indicated that the average motor vehicle wastes approximately 30 per cent of the heat value of the fuel used, as incomplete combustion products. These unnecessary large heat losses are mainly due to improper carburetor adjustment. It was found that if an automobile, motor truck, or tractor

gives good operation without supplying preheated air to the carburetor when a given type of fuel is used, the preheater should not be used. The use of preheated air was found to enrich the carburetor adjustment, especially at high speeds and throttle openings, and at the same time to reduce the mileage which can be obtained per gallon.

It is concluded that the preheater should be used only when necessary, that is, with gasolines which will not give satisfactory operation without preheated air, during cold weather, and before the engine is thoroughly warmed. In the tests an economical adjustment was obtained with a low test gasoline without using preheated air, which gave maximum power when tested on hills at low speeds. When the preheater was used with this adjustment the mileage was reduced, and no measurable increase of power was obtained.

Changing from a low test to a high test gasoline without changing the carburetor setting enriched the carburetor mixture and caused less mileage. This is taken to indicate that if such a change is made the carburetor should be adjusted for a correspondingly leaner mixture. On the other hand, if the change is made from a high test to a low test gasoline, the carburetor setting must be changed to a richer adjustment.

The use of motor benzol with a carburetor adjusted for gasoline resulted in a slightly richer mixture and a slightly increased mileage. When the carburetor was adjusted to a leaner mixture, a 50-50 benzol-gasoline blend gave an increased mileage of 15 per cent.

Heat-treatment of steel springs, J. W. ROCKEFELLER, JR. (*Machinery*, 31 (1924), No. 1, pp. 4, 5, figs. 2).—Studies on the heat treatment of steel springs are reported which showed that the most common practice in the heat treatment of carbon steel springs is to quench in oil at about 1,450° F., and subsequently to draw at from 400 to 800°. The best fatigue resistant properties were found to be developed in a 1 per cent carbon spring steel by quenching at from 1,460 to 1,480° and drawing at about 650°. The elastic limit of a spring steel could be increased by raising the quenching temperature up to at least 1,600°. In general it was found that alloy steels require a combination of higher heat treating temperatures than carbon steels if their best properties are to be brought out.

Heat treatment of steel springs, J. K. WOOD (*Amer. Mach.*, 61 (1924), No. 12, pp. 443-446).—Data on the general requirements for a spring, spring steels and their compositions, and on coiling, forming, and heat treating helical and leaf springs are presented.

The use of the scythe, H. CAMPBELL (*Jour. Dept. Agr. West. Aust.*, 2. ser., 1 (1924), No. 2, pp. 165-171, figs. 7).—Practical information on the correct use of the scythe is presented.

Concrete line posts, H. H. MUSSELMAN (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 51-55, figs. 2).—Practical information on the construction of concrete line posts is presented, including especially data on quantity of materials, reinforcing, and molds.

Trench silo for North Dakota, R. C. MILLER (*N. Dak. Agr. Col. Ext. Circ.* 62 (1924), pp. 20, figs. 8).—Practical information and working drawings for trench silos for North Dakota are presented.

Materials for poultry house construction, E. R. GROSS (*New Jersey Stas. Hints to Poultrymen*, 13 (1924), No. 2, pp. 4, figs. 4).—Brief practical information is presented on the subject.

Poultry houses for Kansas, D. J. TAYLOR and W. G. WARD (*Kans. Agr. Col. Ext. Circ.* 49 (1924), pp. 16, figs. 16).—Practical information and working drawings for poultry houses adapted to Kansas conditions are presented.

Dairy farm buildings, L. T. MACINNES and A. BROOKS (*N. S. Wales Dept. Agr., Farmers' Bul.*, 149 (1924), pp. 31, figs. 37).—Data on the general planning and construction of buildings for dairy farms which are adapted to conditions in New South Wales are presented. These include milking sheds, feed stalls, milk or cream rooms, cow bails (stanchions), combined dairy and separator rooms, bull sheds, calf pens, and reinforced concrete slab dairies.

The home storage room, H. J. GALLAGHER (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 49-51, fig. 1).—A simple design for a winter storage room which is considered to be well adapted for both farm and city homes is presented, together with a bill of materials.

Oil burners for small heating plants, C. J. MYERS (*Iowa Agr. Col., Engin. Ext. Dept. Bul.* 55 (1922), pp. 7, fig. 1).—The results of studies conducted at the Iowa Engineering Experiment Station on fuel oil burners for househeating purposes are reported.

It was found that heating with oil is more convenient than heating with coal, but that the increased convenience is usually secured at an increased cost. The gravity burner costs from \$75 to \$125 installed complete, while the mechanical burner costs from \$450 up but is more convenient to operate. All the fuel oil was found to be about the same in heat value, and the cheapest oil which a burner will consume satisfactorily is considered to be the most economical. It is stated that at present prices the cost of heating with coal and oil is about the same in the central part of Iowa.

RURAL ECONOMICS AND SOCIOLOGY

Studies in the economics of agriculture (*Kansas Sta. Bien. Rpt.* 1923-24, pp. 16-23).—The scope and character of the investigations carried on at the station during the two years ended June 30, 1924, are briefly indicated.

Studies of farm organization and cost of production.—Data as to the average labor material requirements for crop production in McPherson County are tabulated for the three years 1921 to 1923.

The marketing of Kansas wheat.—Data are reported as to the extent and effect on the marketing of Kansas wheat of any shortage in the supply of farm storage space and on the extent of farmers' inability to obtain short-time bank credit and its effect on the marketing of Kansas wheat, and local elevator costs in handling wheat.

[Investigations in agricultural economics at the Kentucky Station] (*Kentucky Sta. Rpt.* 1923, pt. 1, pp. 25-29; 39-41).—A number of projects are reported upon.

Complete cost of production studies.—These studies were begun in 1920 and now include 15 farms in western and 17 in central Kentucky. Some significant contrasts on similar farms in costs of production, efficiency in the use of man and horse labor, and in the item of machinery cost are reported.

A business analysis of 241 farms in Fleming and Mason Counties.—This study was made during the spring and summer of 1923, each farm being analyzed and compared with the average of all farms and with the average of the 10 best farms with respect to net income, size of farm as related to efficiency of man and horse labor, and other points. The relation of economical management to profits is brought out. The profitable farms had expenses of \$46 for every \$100 of receipts, while the unprofitable farms had \$67 of expenses for every \$100 of receipts and the average farm had \$52. The average farmer's net earnings for his year's work was \$1,031. Of this amount, \$332 was the value of meat, poultry, dairy and garden products, etc., which the farm furnished the family.

A business analysis of 84 farms in LaRue County.—This study was conducted along the same lines as the above. A marked difference in the receipts from the 10 best farms and the average of the group as a whole is noted. One factor which had a marked effect on profits was the ability to operate on a minimum of expenditure.

Cost of living study on 360 Mason County farms.—This study was carried on during the summer of 1923 in cooperation with the Bureau of Agricultural Economics, U. S. D. A. Preliminary tabulations are presented here of average expenditures, values of various materials, and the percentage distribution of expense items.

Cost of producing tobacco.—Detailed data covering the cost of producing tobacco in the central Kentucky Burley district and in the dark fired district, collected in 1922, are reported. The average cost per acre for Burley was \$171.67 and for the dark fire cured \$73.36.

Cost of producing strawberries.—Data from farms in Christian County are reported to show that strawberries offer excellent possibilities in many areas of western Kentucky as a cash enterprise supplementing tobacco.

Strawberry marketing.—Data regarding the activities of a number of strawberry marketing associations are briefly noted.

Report of Oregon Agricultural Economic Conference (Oreg. Agr. Col. Bul. 393 (1924), pp. 78).—This report condenses the findings and recommendations of the various commodity groups which were adopted at the conference at Corvallis, January 23–25, 1924. The dairy committee report deals with manufacturing, production, and general considerations. The farm crops committee report is given in sections dealing with grain production, grain marketing, seed recommendations, forage and pasture, potato production and marketing, and weed control. The horticultural committee submits its report in sections on general considerations and the production and marketing of apples and pears, nuts, berries and cherries, prunes, and vegetables. The livestock committee report likewise deals with the situation in general and with regard to the relative position in a livestock program of the production of beef cattle, range sheep, farm sheep, pigs, and goats. Other committee reports are submitted covering poultry, the bee industry, land settlement and land reclamation, marketing, and crop protection.

Farm organization and management [investigations at the Illinois Station] (Illinois Sta. Rpt. 1923, pp. 21, 22).—Brief progress reports are made covering four types of investigations which are being carried on, including farm cost accounting and management, farm power, cost of beef production, and tenancy studies.

A study of farm organization in southwestern Minnesota, G. A. POND and J. W. TAPP (U. S. Dept. Agr. Bul. 1271 (1924), pp. 100, figs. 30).—A study was undertaken cooperatively by the Minnesota Experiment Station and the Department in order to measure the effect of differences in methods and material resources on the efficiency of farm operations. The discussion of the data is presented here in three parts, the first an account of the development of the agriculture of the area from the time of settlement, showing the changes in the crop and livestock enterprises, with some of the main reasons therefor; the second a detailed statement and analysis of the amounts and distribution of labor and materials used in the production of the different crops and classes of livestock on the farms contributing data and of the miscellaneous work incident to the operation of these farms; and the third a discussion of the principles involved in the applications of the data to the constantly recurring problems of choice, combination, and adjustment of enterprises to changing economic conditions and to other more local conditions on particular farms,

together with illustrations. The study of present-day agriculture in Cottonwood and Jackson Counties, begun in March, 1920, was carried on by the complete cost route method during 1920, 1921, and 1922. During the three years 65 complete farm records were secured, including altogether 36 different farms.

Data, including hours of man labor and of horse labor, pounds of seed and of twine, and the quantities of other material required in the production of the principal crops and classes of livestock, are presented in tables showing the range of requirements for the individual farms, as well as the average for the year 1921 and for the preceding and succeeding years. The factors causing variations are indicated, and standard requirement data are shown.

The influence of prices on styles of farm buildings [trans. title], M. BRUNO (*Landw. Jahrb.*, 59 (1923), No. 2, pp. 149-201).—The author traces changes that have taken place in the materials used and the types of buildings erected as culture has advanced and building material markets have become more accessible to agriculture as well as to town populations. Developments in the knowledge of sanitation and in legislative control in this respect have affected farm buildings. As locally derived building materials of wood or field or quarried stone become scarce and manufactured products such as brick, tile, and cement construction are demanded, prices become an important consideration. The use of straw for roofing is affected by the relative importance of grain cultivation, and the demand for straw in raising livestock is discussed. Prices of agricultural products and building materials in Germany are extensively cited for periods including 1861 to 1922.

Estate accountancy, W. R. DUNLOP (*Trop. Agr. [Trinidad]*, 1 (1924), Nos. 4, pp. 58-62; 5, pp. 74-78; 6, pp. 90-92; 7, pp. 106-108, fig. 1; 8, pp. 122-125, fig. 1; 9, pp. 138-140).—This article deals with principles, definitions, and methods, considers the routine work needed to produce financial statements and statistical information, and furnishes examples of balance sheets and other accounts on particular estates. Valuation and depreciation are dealt with. A system of cost keeping primarily for the purpose of arriving at the true cost of the crop at given stages in its production and disposition is described, and specimen accounts are exhibited and discussed. In the last installment of the article some instances of the system as applied to cacao fields are exhibited.

[Report of the Montana Station] department of farm management, E. L. CURRIER (*Montana Sta. Rpt.* 1923, pp. 31-34).—The farmers of Montana are urged to keep accounts and study their costs of production. Several ways of lowering production costs are suggested.

The results of a survey to determine the cost of producing beef in California, R. L. ADAMS (*California Sta. Circ.* 281 (1924), pp. 22).—A study was conducted at the request of certain cattle-producing interests in the State into the costs of producing beef animals under California conditions. Data were obtained from 32 ranches in 17 counties, comprising a gross acreage of 484,283 acres of range. The cow herds varied in size from 53 to 1,800, 12 herds consisting of more than 500 head. The inquiry included a description of the ranch under study, methods of handling and costs, and a calculation of investment in buildings, improvements, and equipment, as well as a record of all labor costs, general expenses, depreciation, interest, and credits. Information was obtained covering costs of marketing, prices obtained, and cattlemen's suggestions as to possible improvements. The period covered was October 15, 1923, to February 1, 1924.

The costs of producing calves to the end of the calendar year in which they were born varied from \$22.47 to \$58.70, the average being \$38. The cost to

the end of the second year averaged \$56.31, ranging between \$32.83 and \$88.04. The net cumulative cost of producing a steer to the selling period in the fourth year when it averaged an age of 44 months was \$108.69. It is deemed wise to dispose of all beef before the beginning of the fourth year. The first year's costs are necessarily high because the cow cost is here assessed against the calf. The gains in weight from the third to the fourth year are relatively small, the cheapest gains being made during the second year of the life of the animal.

Feed and labor, including management, constituted 59 per cent of the cost of raising a calf to the end of the first calendar year, while 67, 71, and 73 per cent, respectively, were involved in the subsequent three years. The improvement of the range and other means of lowering production costs are discussed.

The cost and income of the farm poultry flock, O. R. JOHNSON and B. H. FRAME (*Missouri Sta. Bul. 219 (1924), pp. 20, figs. 5*).—The status of the poultry enterprise on farms cooperating with the rural life department of the station in keeping complete farm records is dealt with here. Data for the years 1912 to 1922, inclusive, are reviewed. The report shows the cost of keeping the poultry flock, considering the labor, feed, cash, and distributed costs, and gives also the proportion of the cost of the ration made up of various feeds. The cost of keeping a hen each year for 11 years and the average total cost are shown, and a comparison is made of costs and income from different sized flocks.

It was found that 1.71 man hours and 0.11 horse hour of labor were required to care for the average farm hen one year. The average cost of keeping poultry for the 11 years was \$1.18 per hen, which was divided as follows: Labor 28.6 per cent, feed 56.3, cash 7.5, and distributed costs 7.6 per cent. The total income from poultry was \$1.67 per hen, realized from the following sources: Sales of poultry and eggs \$1.32, products used 25 cts., miscellaneous income 10 cts. The average hen returned 49 cts. in income above cost of keep. The most successful year was 1921 with a margin of \$1.29, and the least successful was 1916 with a loss of 11 cts. per hen. When flocks were compared on the basis of size, it was found that the total cost of keep decreased from 100 to 300 hens. The flocks larger than 300 cost as much as the smallest flocks.

Child labor on Maryland truck farms, A. CHANNING (*U. S. Dept. Labor, Children's Bur. Pub. 123 (1923), pp. V+52, pls. 5*).—The study reported upon here was made during May, June, and July, 1921, in Anne Arundel County near Baltimore and in Wicomico, Somerset, and Worcester Counties in the Peninsula or Eastern Shore section of Maryland. School records of children working on farms were secured, and the families of the children were visited in order to obtain detailed information.

Altogether 808 white and negro children, including migratory laborers, were interviewed in Anne Arundel County, 540 of whom lived in the area. Some plowing, harrowing, cultivating, and lifting of heavy baskets of vegetables was done by the boys over 12 years. Almost every child who does farm work at all helps with harvesting, and many of the children in the region reported work at planting and transplanting. In the areas surveyed on the Eastern Shore many of the older children worked a total of 60 or more days during the season from May to October. A working day of 9 or more hours was reported by one-half the white and negro boys on the Eastern Shore and by one-half the boys of Anne Arundel County.

Nearly one-fifth of the white children had been absent for farm work 30 or more school days or 6 or more school weeks during the preceding school

year. Fewer negro children lost so much time from school for farm work for the reason that their schools are closed during the large part of the busy season on truck farms. The majority of the children of migratory workers lose from 4 to 6 weeks at the end of the school term. Over two-thirds of those included in the study were retarded in school at a rate which for children from 10 to 14 years of age is about twice the average for city school children.

The housing provided for migratory truck farm workers in these localities is deemed so unsatisfactory as to call for some public supervision.

Adjusting agricultural production and distribution in south central West Virginia to meet home market demands, W. W. ARMENTROUT, H. T. CROSBY, and H. I. RICHARDS (*West Virginia Sta. Bul.* 188 (1924), pp. 64, figs. 22).—This report presents the results of a food consumption, production, and distribution survey of Charleston, W. Va., and its trade territory, including 13 counties which together make up three geographical divisions, the Ohio River area, the mountainous area, and the Greenbrier area. Data were collected for the year ended December 31, 1923. The first part of the report presents facts which show what may be expected as to the constancy of market demand. The second part details the quantities of selected food commodities shipped into the Charleston market, the quantity remaining in Charleston, and the quantity going to the outlying trade. The third part describes the distributing machinery as it is set up in Charleston, while the fourth determines the status of commercial production of dairy products, potatoes, truck crops, fruit, poultry, and meats.

Soil and climatic conditions are found to be adapted to the production of each of the important perishable food commodities included in the study. Charleston and its trade territory furnish a large demand for high quality products to which local producers should cater. Recommendations are offered with respect to increasing the production of the commodities considered.

Financing agricultural exports from the United States, G. W. EDWARDS (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul.* 241 (1924), pp. II+46).—This study deals with the general aspects of financing export trade, with particular reference to agricultural products. It outlines the fundamental principles involved, treating the subjects of the credit policy of exporters, the use of documentary collateral in granting credit, international bank organizations and financial methods, and financing exports to countries with depreciated currencies.

Crops and Markets, [November, 1924] (*U. S. Dept. Agr., Crops and Markets*, 2 (1924), Nos. 18, pp. 273-288; 19, pp. 289-304; 20, pp. 305-320, fig. 1; 21, pp. 321-336; 22, pp. 337-352).—The usual current weekly abstracts and reviews of prices and the supply on the markets of farm products are presented, together with detailed tabulated data and brief notes with reference to foreign crops and foreign market conditions.

Monthly Supplement to Crops and Markets, [November, 1924] (*U. S. Dept. Agr., Crops and Markets*, 1 (1924), Sup. 11, pp. 361-392, figs. 3).—Estimated crop conditions and data with reference to crop production, farm prices, the receipts and disposition on the markets of important agricultural commodities, and other statistical data are tabulated and commented upon. Cotton reports are featured, and reviews of world agriculture and the price situation for October, with comparisons, are presented.

The lower Rio Grande Valley of Texas, A. T. POTTS (*Texas Sta. Circ.* 34 (1924), pp. 3-13).—Information with regard to general conditions, soils, climate, irrigation and drainage, and general crop adaptation, gathered in this region

in locating a citrus experiment station, is summarized in these pages for the use of prospective settlers.

Agricultural production in Denmark, H. FABER (*Jour. Roy. Statis. Soc., n. ser.*, 87 (1924), No. 1, pp. 22-62).—The quantity of human food produced annually by Danish farmers on 100 acres and the number of persons fed in five years before the war and in the year 1922 are estimated here. The amounts of corn and other feeding stuffs imported are also noted. It is pointed out that the animal industry in Denmark, like other industries, is carried on by using freely raw materials either from home or abroad.

Some economic and social phases of French agriculture, A. HOBSON (*Jour. Farm Econ.*, 6 (1924), No. 3, pp. 233-244).—A brief analysis is presented of population with particular reference to the agricultural population, farm labor, size of farms, land values, the devastated area, and agricultural thrift in France as these economic and social factors may be regarded as affecting agricultural tendencies in France.

Increases and decreases in the open country population of Ohio, 1910-1920, C. E. LIVELY (*Jour. Farm Econ.*, 6 (1924), No. 3, pp. 248-253, figs. 2).—Census returns from the 1,317 townships in Ohio outside of Cuyahoga and Hamilton Counties and a number of townships which are entirely incorporated as village and urban territory are studied. It is indicated that for the State as a whole the unincorporated villages increased 11.6 per cent, while the true open country population declined 5.2 per cent. In the 86 counties of the State exclusive of the two mentioned above, there were 13,844 fewer farms in 1920 than in 1910 and a loss of 1.4 persons for each farm lost.

Diagnosing the rural church, C. L. FRY (*New York: George H. Doran Co., 1924, pp. XXVI+27-234, figs. 25*).—This report presents a summary of the results of the Interchurch World Movement survey, brought to completion by the Institute of Social and Religious Research and published as the Town and Country Series (E. S. R., 48, p. 493).

Part 1 deals with the methods of measuring churches, and part 2 is an attempt at correlating the facts in order to discover some of the measurable tendencies that operate on some of the rural fields. This discussion covers the effect upon church life of economic prosperity, density of population, regional characteristics, the racial make-up of the population, illiteracy, and the occupation of the inhabitants, as well as the factors within the churches themselves, especially in the way of the effects of leadership and the number of members upon the differences between churches. Part 3 presents a comparison of church data in Windsor County, Vt., secured by E. Hooker in the summer of 1922, with comparable material collected more than a decade ago by Gill.¹ A more detailed discussion of the investigation of attendance interest noted by Brunner (E. S. R., 51, p. 893) is given in chapter 8.

AGRICULTURAL EDUCATION

New methods in teaching vocational agriculture, G. A. SCHMIDT (*New York and London: Century Co., 1924, pp. XV+268, pl. 1, figs. 20*).—Suggestions to teachers brought together here are based on the author's experience, yet published material is also extensively cited. The first part of the volume is addressed particularly to superintendents, high school principals, and school boards, outlining the aims and the value of the vocational agricultural program.

¹ The Country Church, C. O. Gill and G. Pinchot. New York: Macmillan Co., 1913, pp. XII + 222.

The organization of subject matter, job analyses, and classroom procedure are then treated in detail. It is held that lesson planning should include the making of a yearly teaching plan, job outlines, the horizontal layout or the arrangement of the enterprises in a vertical column and those of the jobs in each enterprise in a horizontal column opposite the name of the enterprise and in the monthly column in which the job is to be taught, the monthly teaching plan, analyses of jobs, teaching layout of jobs, and operating sheets for exercises. One chapter deals with the analysis necessary for managerial jobs. Another gives the publishers of bulletins valuable as reference material, presents methods of classifying and filing such bulletins, and lists textbooks and laboratory manuals. Other chapters are concerned with the home project; farm shop work; rooms, equipment, and supplies; part-time and evening instruction; additional summer activities of the vocational agriculture instructor; interest and publicity; and professional improvement. Suggestive blanks for the use of teachers and pupils and other illustrative material are included throughout the book.

Agricultural education: Desirable programs for the future, D. SNEDDEN (*Vocat. Ed. Mag.*, 2 (1924), No. 13, pp. 1032-1035).—It is held that secondary vocational agricultural education of the near future will demand increased maturity on the part of its students, that it must become increasingly basic rather than technical, and above all that it must train the student to differentiate between those fields of service in which he must be primarily a producer of utilities and those in which he must be a trained user or purchaser of the expert services of others.

The author holds that the home project method is fundamentally the right one for beginners. A considerable separation in administration between extension and short unit agricultural education and that of secondary schools is deemed desirable. Not all consolidated schools can offer secondary agricultural education. That portion of the liberal or general education of agricultural students that is to be acquired in full-time schools should be acquired before the beginning of intensive training in agriculture.

Linking class instruction in agriculture with the agriculture of the community, J. O. MONTEGUT (*Vocat. Ed. Mag.*, 2 (1924), No. 13, pp. 1031, 1032).—This note gives an instance of how the classroom study of the diseases and insect pests that attack fruit trees developed community interest in pruning and spraying and also of the practical value of demonstrations in hog cholera inoculation, planting certified seed potatoes, and the use of fertilizers.

How can we measure the actual results in vocational agriculture? R. B. SMITH (*Vocat. Ed. Mag.*, 2 (1924), No. 13, pp. 1035-1039).—Numerous means of judging as to the success of vocational agricultural departments or schools, as well as of former students, are briefly pointed out. Several statistical surveys presenting information along this line are also noted.

Extension work in plant pathology, 1923, F. C. MEIER (*U. S. Dept. Agr., Dept. Circ.* 329 (1924), pp. 20, figs. 9).—Most of the extension effort was applied to the four activities of the introduction of resistant varieties, seed disinfection, spraying, and seed selection, which are reported upon in detail here. The extent of the control operations that were brought about as a result of extension teaching during the year is reported statistically.

Outlines of economic zoology, A. M. REESE (*Philadelphia: P. Blakiston's Son & Co.*, 1924, 2. ed. pp. XIX+318, figs. 194).—This textbook is based upon a brief college course given by the author to students who have completed the general elementary course. It may be used also in the beginning course or as supplementary reading in connection with it. A bibliography of 222 titles is given

as an aid to students who may develop a particular interest in some animal or group of animals.

Demonstration courses in wood utilization (*U. S. Dept. Agr., Misc. Circ. 29 (1924), pp. 22, figs. 14*).—Details of demonstration courses in the kiln drying of lumber, boxing and crating, the gluing of wood, and wood properties and uses, which are offered at the Forest Products Laboratory, maintained cooperatively at Madison, Wis., by the University of Wisconsin and the U. S. Department of Agriculture, are presented here. These courses are designed to give basic knowledge and its practical application and are attended by representatives of manufacturing firms, trade specialists, salesmen, and consumers.

MISCELLANEOUS

Work and expenditures of the agricultural experiment stations, 1922, E. W. ALLEN, W. H. BEAL, E. R. FLINT, ET AL. (*U. S. Dept. Agr., Off. Expt. Stas., Work and Expend. Agr. Expt. Stas., 1922, pp. 158*).—This report contains a discussion of the activities of the stations during the fiscal year ended June 30, 1922; a résumé entitled *Some Results of Station Work*, by E. R. Flint; four articles dealing with specific phases of their work noted elsewhere in this issue; *Statistics of the Stations*, by J. I. Schulte; and a list classified by subjects of the publications of the stations received during the year.

For the fiscal year the total income of the stations was \$8,125,404.37, comprising \$1,440,000 Federal funds derived under the Hatch and Adams Acts, \$4,901,139.50 State support, \$183,193.99 income from fees, \$907,934.66 returns from the sale of products, \$330,078.97 income from miscellaneous sources (including \$210,000 Federal appropriations for the insular stations), and \$363,057.25 carried over as balances from the previous year. During the year the stations added equipment aggregating \$1,185,265.12 and classified as follows: Buildings \$735,823.16, library \$27,362.20, apparatus \$92,123.16, farm implements \$115,266.80, livestock \$110,665.32, and miscellaneous \$104,024.48.

In the work of administration and inquiry the stations employed 2,166 persons, of whom 1,100 were also members of the teaching staff of the colleges and 364 assisted in the various lines of extension work. During the year the stations issued 1,064 publications, including annual reports, bulletins, and circulars, aggregating 24,592 pages and distributed to 889,394 addresses on the regular mailing lists.

Thirty-sixth Annual Report [of Illinois Station, 1923], H. W. MUMFORD (*Illinois Sta. Rpt. 1923, pp. 24*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1923, brief notes as to the principal lines of work, and a list of publications of the year. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

[Report of Kansas Station, 1923-1924], F. D. FARRELL (*Kansas Sta. Bien. Rpt. 1923-24, pp. 145, figs. 2*).—This contains the organization list, financial statements for the biennium ended June 30, 1924, and a report of the director summarizing the work and publications of the station. The experimental work recorded not previously noted is for the most part abstracted elsewhere in this issue.

Thirty-sixth Annual Report of the Kentucky Agricultural Experiment Station for the year 1923, Part I, T. P. COOPER (*Kentucky Sta. Rpt. 1923, pt. 1, pp. 59, figs. 2*).—Part 1 of this report contains the organization list, a financial statement as to the Federal funds for the fiscal year ended June 30, 1923, a report of the director on the work of the year, and meteorological

data. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

Abstracts of papers not included in bulletins, finances, meteorology, index (*Maine Sta. Bul. 315* (1923), pp. 95-118+XII).—This contains the organization list of the station; abstracts of five papers previously noted and of five others abstracted elsewhere in this issue; meteorological observations noted on page 415; a financial statement for the fiscal year ended June 30, 1923; an index to Bulletins 310-315, inclusive, which collectively constitute the thirty-ninth annual report of the station; and announcements as to the work and publications of the station.

Agricultural service from the Montana Experiment Station: Thirtieth Annual Report, July 1, 1922, to June 30, 1923, F. B. LINFIELD ET AL. (*Montana Sta. Rpt. 1923*, pp. 71, figs. 32).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1923, and a report of the director and heads of departments on the work of the station. The experimental work reported and not previously noted is for the most part abstracted elsewhere in this issue.

The Quarterly Bulletin [of the Michigan Station], edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul.*, 7 (1924), No. 2, pp. 41-70, figs. 6).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Feeding Soft Corn, by G. A. Brown; The Corn Situation by J. F. Cox; and Value of Hardy Alfalfa, by F. A. Spragg.

Monthly Bulletin of the Ohio Agricultural Experiment Station, [July-October, 1924] (*Ohio Sta. Mo. Bul.*, 9 (1924), Nos. 7-8, pp. 105-136, fig. 1; 9-10, pp. 137-184, figs. 23).—Of these numbers, No. 9-10 contains, in addition to several articles abstracted elsewhere in this issue, articles entitled Essentials in Rations of Fall Pigs; Bread and the Diet, by C. H. Hunt; Cornfield Alone Inadequate for Lambs; and Steers Need Protein Feeds.

Summary of publications (*Utah Sta. Circ. 53* (1924), pp. 4).—Summaries are given of Bulletins 188-190 and Circulars 49-52, previously noted, and Bulletin 191, noted on page 454 of this issue.

NOTES

Illinois University and Station.—A respiration apparatus sufficiently large to accommodate cattle and small horses is to be installed for the use of the division of animal nutrition. Metabolism crates for sheep and swine and a respiration apparatus for poultry are also to be provided.

Dr. I. B. Boughton, acting chief of animal pathology and hygiene, has resigned to become director of animal disease control work in Haiti, taking over the duties carried on for several months by Dr. Robert Graham, chief of animal pathology and hygiene, who has been on leave of absence from the university and will shortly return to this position. W. E. Carroll, head of the department of animal husbandry of the Utah College and Station, has been appointed professor and chief in swine husbandry.

Kansas College and Station.—The appropriations made by the 1925 session of the legislature for the support of the college and station during the biennium beginning July 1 aggregate \$2,797,400. This represents an increase of 18 per cent over the appropriations made two years ago for the current biennium. The principal items involved in the increase are an appropriation of \$250,000 for a library building and an appropriation of \$200,000 for a women's dormitory. Other special items include \$10,000 for a sheep barn, \$10,000 for new greenhouses, \$10,000 for soil surveys, and \$22,000 for additional land. A small increase was also granted in the appropriations for the support of the substations.

The Kansas Industrialist states that under a seed inspection law enacted by the last legislature a seed testing laboratory is to be established at the college. Administrative phases of the work, including the collection of samples, will be handled by the State Board of Agriculture at Topeka.

The State Livestock Registry Board, which has had its headquarters at the college since 1910, has been abolished and its duties transferred to the State Board of Agriculture. The State Dairy Commissioner's Office, located at the college since its establishment in 1907, is also to be removed to Topeka for consolidation with other offices of the State Board of Agriculture but is still being maintained at the college because of a shortage of available quarters.

The home economics department of the college celebrated its semicentennial April 16-18. The home economics building, dedicated in 1908, was formally designated Calvin Hall in honor of Mrs. Henrietta W. Calvin, a graduate in the class of 1886 and head of the domestic science department from 1903 to 1908. The degree of doctor of laws was conferred on Mrs. Calvin and Mrs. Nellie Kedzie Jones, a pioneer instructor in home economics in the college, and that of doctor of science on Miss Abby L. Marlatt, dean of the department of home economics of the University of Wisconsin.

Two important experiments in mineral metabolism were started during the past year. In the first, four dairy cows on carefully cured alfalfa hay, beet pulp, and a 4:2:1 grain mixture showed a positive calcium balance through four one-week periods. The removal of the ovaries from two cows and the injection of the other two with ovarian extract had no apparent effect on mineral metabolism, since a positive calcium balance similar to the first period

was obtained on the second four one-week periods. In the second series, including three trials on the effect of ultraviolet light on milk production, a rather marked increase in milk flow was obtained in one trial with four cows and a slight increase in a later trial with six cows, while the final trial with eight cows gave no appreciable increase that could be attributed to the ultraviolet light treatment.

Following the appointment of President W. M. Jardine as Secretary of Agriculture, F. D. Farrell, dean of the division of agriculture and director of the station, has been appointed acting president, effective March 1. L. E. Call has been appointed acting dean and acting director in his stead, and R. I. Throckmorton acting head of the department of agronomy.

P. L. Gainey, soil bacteriologist of the station, has been granted a semester's leave of absence for a special study of the energy requirements of nitrogen fixation in soils to be carried on at the graduate laboratory of the Henry Shaw School of Botany of Washington University and the Missouri Botanical Garden. D. R. Porter, extension assistant in plant pathology at the Iowa College, has been appointed specialist in plant pathology vice E. A. Stokdyk who has been designated marketing specialist for the division.

Michigan College and Station.—Under an act of Congress passed March 2, the Secretary of Agriculture is directed to transfer the U. S. Weather Bureau site and buildings on the college grounds to the State of Michigan, receiving in lieu thereof another site of approximately equal area and a cash payment of \$25,000. Another weather bureau station is to be erected on a new site at a cost not to exceed \$38,000.

The college has arranged a series of five radio courses of two weeks' duration, these being broadcasted through its station WKAR from March 2 to May 8. The courses included farm machinery and home conveniences, farm crops, soils, and fertilizers, poultry and livestock, home gardening and vegetables, and a home makers' course. An enrollment of 500 is reported.

The annual farmers' week with an attendance estimated at 8,000 is considered the most successful in the history of the college.

A soil survey has now been completed in 18 counties of the State. The work is carried on in connection with the Bureau of Soils, U. S. D. A., and the State Conservation Department.

The mint flea-beetle, *Longitarsus menthae*, a small brownish-yellow flea-beetle, has been causing serious injury to peppermint and spearmint crops. Investigations have revealed that the pest is a new one, apparently never having heretofore been studied nor named.

Dr. G. H. Coons, research associate in plant pathology, has been granted leave of absence for one year, beginning April 1, to conduct investigations with the Office of Sugar Plant Investigations, U. S. D. A., covering the development of disease resistant beets, with special reference to the leaf spot disease.

Dr. H. J. Stafseth, associate professor of bacteriology and specialist in diseases of poultry, has been appointed exchange professor under the American Hungarian Foundation, and will spend a year in study at the University of Budapest.

J. A. Nahstoll has been added to the extension staff for work in accounting and business practices with the various cooperative organizations of the State.

Missouri University and Station.—A new wing is being added to the home economics building. This additional space will double the capacity of the home economics department. It will not only relieve the present crowded student facilities but will provide more adequately for research in foods, nutrition, textiles, clothing, and home management.

The department has recently instituted two new projects. The first of these is designed to find the causes of vitamin destruction in cooked and canned foods. The second is an investigation of the baking qualities of Missouri flours. A special laboratory has been fitted up for this work.

The photographic equipment of the station has been increased by the purchase of a new 8 by 10 in. automatic enlarging machine, an excellent microscope and microscopic camera, and suitable equipment for color photography. The station now utilizes the full time of one photographer.

Dr. A. E. Murneek, formerly assistant in horticultural research at the Oregon Station, has been appointed assistant professor of horticulture and entered upon his duties February 1.

New Hampshire University and Station.—The State legislature has passed a mill tax bill for the support of the university, providing for each fiscal year "a sum equal to one mill on each dollar of the assessed valuation of the taxable property in the State as of the first day of April of the calendar year preceding each biennial period." During the next two years this appropriation is expected to amount to about \$585,000 a year. The sum is exclusive of any revenue which may be derived from trust funds or other sources, and is in addition to all income derived from dormitory rentals, sales of farm produce, and the like. The amount for the coming year will represent an increase of about \$230,000 over that of the current year, and the measure will make it possible for the president and trustees to make their plans on the basis of a definite income. In anticipation of a building program the act provides for borrowing in anticipation of income to the extent of \$100,000, to be repaid from the income of the succeeding fiscal year.

No specific provision is made for State support of the station, but allotments to it may be made from the mill tax funds. The legislature, however, appropriated \$36,000 per year for extension work. This is intended to put the county extension work on a permanent public fund basis in the proportion of one part Federal funds, two parts State funds, and three parts county funds, and to provide for agricultural, home demonstration, and junior work in each county.

Because of an increasing out-of-State enrollment the legislature stipulated that after July 1, the number of students entering the university from the States of Maine, Massachusetts, and Vermont should not exceed 8 per cent of the total enrollment of the entering class of the four-year course of the preceding year, and that the enrollment of new students from other States should not exceed 4 per cent of this figure.

American Tour of German Scientists.—A party of German agricultural scientists arrived in this country in April to spend several months in a tour including visits to the U. S. Department of Agriculture and many of the experiment stations. The party consists of Dr. Friedrich Hagedorn, Undersecretary of Agriculture, who is especially interested in agricultural economics and finance; Dr. Theodore Brinkmann, professor of rural economics, University of Bonn; Dr. George Kuehne, agricultural engineer, University of Munich; Dr. Theodore Roemer, professor of plant breeding, University of Halle, and Joachim Deicke, large farm owner and former chief of the division of animal breeding of the Agricultural Chamber of the Province of Brandenburg.

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RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Preparation of a basic arsenate of lead of definite composition, L. R. STREETER and R. W. THATCHER (*Indus. and Engin. Chem.*, 16 (1924), No. 9, pp. 941, 942).—After unsuccessful attempts at preparing basic lead acetate of uniform composition by the methods suggested by Robinson and Tartar (E. S. R., 33, p. 801) and McDonnell and Smith (E. S. R., 37, p. 410), the lead subacetate method was used with much more satisfactory results. In this method a dilute solution of lead subacetate was prepared by heating nearly to boiling for about 30 minutes 430 gm. of neutral lead acetate, 130 gm. of litharge, and 1,000 cc. of water, allowing the mixture to cool and settle, and decanting the clear solution. To 100 cc. of this solution, diluted with 1,500 cc. of water, a solution of disodium arsenate was added in slight excess at ordinary room temperature. The precipitate was washed several times with water by centrifuging and decanting and finally dried.

In several trials of this method the precipitates were found to be uniform in physical properties and to vary but little in chemical composition. In five lots analyzed, the ratio of PbO to As_2O_5 varied only from 3.155 to 3.170. This ratio is slightly lower than the theoretical for basic lead arsenate of the formula $Pb_4(PbOH)(AsO_4)_3$, 3.239. Attempts to explain the failure to produce theoretical results led to the conclusion that the excess of disodium arsenate required to obtain a precipitate of desirable physical qualities reacted with some of the basic lead arsenate to form neutral lead arsenate. The product is, however, considered to be generally satisfactory for chemical and insecticidal studies requiring a basic arsenate of lead.

Chemical studies of the combined lead arsenate and lime-sulfur spray, R. W. THATCHER and L. R. STREETER (*New York State Sta. Bul.* 521 (1924), pp. 3-20).—A systematic study is reported of the chemical reactions taking place between the different arsenates of lead and lime sulfur in the varying proportions in which they are combined for spraying purposes, and of possible methods of preventing the changes found to occur.

The general method of procedure consisted in preparing the different arsenates of lead by the methods described above, mixing them with lime-sulfur solutions in different proportions, adding in some cases other materials, allowing the mixtures to stand for different lengths of time, and finally filtering off the precipitated material, weighing it, and determining its nature.

With mixtures of acid lead arsenate and lime sulfur alone, a definite chemical change was found to take place with an increase in insoluble material to

nearly double the original amount. The change required nearly 24 hours for completion. The solid material was found to contain some unchanged lead arsenate, large proportions of lead sulfide and calcium arsenate, and about 20 per cent of free sulfur. The filtrate contained more soluble arsenic than was present in the original mixture. As a result of these changes, the mixture would be less fungicidal and more harmful to the foliage.

Of the various materials added to prevent these changes taking place, calcium hydroxide, when added in the proportion of at least 5 lbs. per 100 gal. of the mixture, prevented any chemical reaction taking place, but increased decidedly the solid matter in the mixture and added considerably to the cost of the spray. Casein, when used in proportions as small as 2.8 oz. of dry casein to 100 gal. of the spray mixture, proved an excellent protector. Various other colloidal materials tested, including glue, gelatin, egg albumin, and saponin, were ineffective alone when used in amounts as large as 1 or 2 lbs. per 100 gal. of the spray mixture. Mixtures of these materials with calcium hydroxide gave more protection, but not equal to that of casein alone. Various casein-containing materials, such as buttermilk, skim milk, and whole milk, were unsatisfactory when used alone on account of reaction with the lime sulfur with the setting free of sulfur. The same products with added calcium hydroxide gave satisfactory results.

In tests to determine the minimum amounts of skim milk and calcium hydroxide to be fully effective, it was found that 1 qt. of skim milk and 1 lb. of calcium hydroxide per 100 gal. of mixture afforded complete protection so far as could be judged by laboratory tests. Commercial preparations of casein, such as Kayso and calcium caseinate, were equally effective in proportions of 0.5 lb. to 100 gal. Tobacco dust, sometimes added to the combined sprays to increase their insecticidal action against certain types of insects, was also found to prevent chemical changes taking place between the arsenate and sulfur compounds without the addition of any casein-containing materials.

It is pointed out that further orchard experiments are necessary to determine whether the addition of casein preparations to the combination spray will completely eliminate the danger of foliage burning, but it is thought probable that the danger of this will be greatly reduced, if not entirely eliminated.

The isolation and identification of quercetin from apple peels, C. E. SANDO (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 12, pp. 1243-1245).—The investigation previously noted (*E. S. R.*, 50, p. 7) has been extended to the isolation of the yellow flavonol pigment occurring in apple peels and its identification as quercetin.

The material used consisted of the residue from the steam distillation of the peels of McIntosh apples in the investigation of Power and Chestnut on the odorous constituents of apples (*E. S. R.*, 48, p. 607). The dried peels were first extracted separately with petroleum ether and ether to remove chlorophyll, carotinoids, and wax-like substances and then continuously for several weeks with 95 per cent alcohol. The extraction was conducted in the continuous extraction apparatus described on page 503. From the alcohol extract the coloring matter was obtained by precipitation with basic lead acetate and subsequent decomposition of the precipitate with 5 per cent sulfuric acid and shaking out with ether. The pigment was identified as quercetin, $C_{15}H_{10}O_7$, by means of its penta-acetyl derivative and by combustion of the purified pigment.

It is suggested that the brown discoloration of scalded apple peels may be produced on the interaction in the tissues of quercetin and oxidase.

Tomato products investigations (*New York State Sta. Rpt. 1924, p. 26*).—Gaseous fermentation occasionally occurring in tomato catsup was found to be due to an organism possessing the characteristics of the group of lactobacilli except for a more abundant gas formation. The organism is easily killed by heat, but its presence in catsup is accounted for by the catsup being allowed to cool below 170° F. before bottling. The growth of the organism was not checked by 0.1 per cent sodium benzoate nor the usual amounts of acid.

Continuous extraction apparatus for large quantities of plant materials, C. E. SANDO (*Indus. and Engin. Chem., 16 (1924), No. 11, p. 1125, fig. 1*).—The apparatus consists of an electric heater provided with a soapstone ring, a round-bottom flask for the solvent, an aspirator bottle for the plant material, and an ordinary reflux condenser. The round flask is connected by tubes with the upper and lower part of the aspirator bottle in such a way that the vapor of the solvent enters the aspirator at the top, where it condenses and collects on the plant material and finally siphons back into the flask. With a 5-liter flask and an aspirator of the approximate dimensions 17 by 26 cm., about 1 kg. of material can be used for the extraction.

The chemistry of milk and dairy products from a colloidal standpoint, L. S. PALMER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1157–1168*).—The author summarizes and discusses recent advances in the colloidal chemistry of milk, cream, ice cream, butter, cheese, condensed milk, and dried milk. A list of 33 references to the literature is appended.

The chemistry of casein, L. L. VAN SLYKE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1145–1152*).—This paper consists of a brief summary of present knowledge concerning casein with respect to its importance, amount in normal milk, commercial relations, preparation, and composition. In the section on preparation, recent developments in the author's method (*E. S. R., 41, p. 201*) are outlined.

On the presence of amylase in milk and cheese, M. SATO (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1174, 1175*).—The author reports the presence of amylase in samples of grade A certified milk and in American Cheddar cheese. A comparison of the rate of digestion of various starches by the amylase showed soluble potato starch to be digested more easily than rice starch and this in turn more easily than ordinary potato starch.

The heat coagulation of milk, H. H. SOMMER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1241–1243*).—Essentially noted from another source (*E. S. R., 49, p. 73*).

Factors influencing the heat coagulation of milk and the thickening of condensed milk, A. LEIGHTON and E. F. DEYSHER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1276–1284, figs. 5*).—Essentially noted from another source (*E. S. R., 49, p. 716*).

The crystals found in sweetened condensed milk, M. SATO (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, p. 1285*).—The microscopic examination of crystals from samples of commercial sweetened condensed milk showed two types of crystals, "one taking a bushlike form of needles and their masses, and the other taking a trapezoidal form. The former on analysis was found to be mostly tricalcium citrate ($\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2$), and sometimes the crystals of tyrosine were found therewith. There were also present tricalcium phosphate ($\text{Ca}_3(\text{PO}_4)_2$) and magnesium phosphate ($\text{Mg}_3(\text{PO}_4)_2$) in an amorphous condition, and the crystals of leucine and cystine were also observed. The crystal in a trapezoidal form was found to be the same as that of milk sugar in its chemical nature, the crystalloid having doma but generally lacking the M face and M' face that are found in the pure milk sugar."

The principal factors affecting the keeping quality of sweetened condensed milk, A. MIYAWAKI (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1233-1240*).—The conclusions drawn in a study extending over several years of the causes of deterioration in sweetened condensed milk are discussed, with illustrative data.

In the opinion of the author deterioration of condensed milk may be due either to bacterial or physical changes on aging. The most common and troublesome form of deterioration is thickening, which may be caused either by aging, in which case it is corrected by stirring, or by bacterial action, in which case the change is irreversible. To avoid thickening, the following precautions are recommended:

The milk to be used should contain more than 3 per cent butterfat, the amount of sugar to be added should be more than 15 per cent of the whole milk by weight, the vacuum should be maintained at higher than 26 in., and the condensing should be finished in less than 25 minutes per 1,000 lbs. of fresh milk.

The keeping quality of butterfat, with special reference to milk powder, G. E. HOLM and G. R. GREENBANK (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1253-1265, figs 4*).—Some of the data and conclusions presented in this paper have been noted previously (*E. S. R., 51, p. 806*). The development of tallowiness in milk powders is considered to be due to the oxidation of some of the butterfat. Evidence is presented that moisture not only retards the development of tallowiness but prevents the formation of intermediate products, aldehydes, etc., giving rise to the tallowy odor.

Sediments of evaporated milk, M. SATO (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1284, 1285*).—Crystals in the bottom of a can of evaporated milk which had been kept for over two years were found on analysis to be composed of tricalcium phosphate ($\text{Ca}_3(\text{PO}_4)_2$), magnesium phosphate ($\text{Mg}_3(\text{PO}_4)_2$), and tricalcium citrate ($\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2$).

The solubility of milk powder as affected by moisture content, G. C. SUPPLEE and B. BELLIS (*Jour. Dairy Sci., 8 (1925), No. 1, pp. 39-46*).—The term "solubility" as applied in this paper is defined as "the ability of desiccated milk when mixed with water to form a solution, suspension, or emulsion which will simulate the physical characteristics of natural milk." Decreased solubility of milk powders during storage is a type of deterioration the cause of which was made the subject of the present investigation.

Samples of desiccated milk made by the Just and the spray processes were packed in air-tight containers so constructed that the air could be circulated through them at will, and were subjected for varying periods of time to air containing varying amounts of moisture. The samples after definite periods of storage were reconstituted according to a fixed process, and then centrifuged and the total proteins and casein determined in the supernatant liquid.

The data showed that increased absorption of moisture was accompanied by decreased solubility. By the time the water content of the powder had increased from 2 to about 11 per cent there was a complete absence of casein in suspension. This was true whichever process was used. Moisture-free air circulated through the powder in the same way had no effect upon the solubility.

It is concluded that milk powder containing less than 3 per cent of moisture may be kept for a year without loss in solubility of the casein. Samples in which the moisture content had been maintained at from 3 to 5 per cent, with but slight change in solubility during a period of one year, became almost entirely insoluble within a few days when the moisture content was raised to from 6.5 to 7 per cent.

An analysis of the material separated from the reconstituted milk by centrifugation showed it to contain approximately 93 per cent protein and 7 per cent ash, the latter being composed almost entirely of the oxides of calcium, phosphorus, and magnesium. It is thought that the greater part of the precipitated ash is insoluble calcium phosphate.

The keeping quality of dry milk, G. C. SUPPLEE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1248-1253*).—The types of deterioration discussed are staleness, rancidity, and tallowiness. Staleness, which is accompanied by decreased solubility and darkening in color, is most likely to occur in skim milk powder and is considered to be due to excessive moisture content (see above). Rancidity and tallowiness, types of deterioration occurring in whole milk powders, are attributed to changes occurring in the fat from enzyme action and oxidation, respectively.

A new method for the determination of the water content of milk powder and the properties of its colloidal constituents [trans. title], E. A. HAUSER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1154-1157, fig. 1*).—The method described is based upon the temperature change taking place when a given amount of the milk powder is dissolved in a given amount of water. With powder of from 0 to 3.5 per cent moisture, the addition of water causes a rise in temperature due to the heat of swelling and the heat of hydration of lactose. At a higher moisture content there is also a negative heat reaction due to the solution of the mineral salts. The resulting temperature change under these conditions is the difference between the heat of swelling (positive) and the heat of solution (negative). Curves have been worked out for the temperature rise in standard milk powder with different amounts of water.

Freezing point of colostrum milk, normal milk, and end milk of lactation; and its practical value for detection of water added, M. SATO (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1173, 1174*).—The minimum, maximum, and average values for the freezing point of a large number of samples of colostrum, normal, and end-of-lactation milk from cows of different breeds are given as follows: Colostrum milk $\Delta = -0.5$, -0.64 , and -0.567 and end milk $\Delta = -0.53$, -0.57 , and -0.552 . The ranges for normal individual and mixed milk were $\Delta = -0.51$ to -0.59 and -0.53 to -0.58 , with a general average of -0.548 .

The author considers that the freezing point method can be used with some degree of certainty for detecting the addition of 5 per cent of water and accurately for 10 per cent.

The necessity for legislative control in the sale of milk breads, R. M. ALLEN (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1315-1317*).—Included in this plea for the adoption of standards for the milk content of milk bread is a tentative method for the determination of the milk content of bread. This includes the determination of lactose and of fat.

For the former, from 50 to 60 gm. of fresh or air-dried bread are digested in distilled water at about 40° C. for one hour, and the extract is separated by adding 20 gm. of Filter-Cel, centrifuging twice, and finally filtering through a Buchner funnel containing Filter-Cel. To the extract are added 35 gm. of starch-free yeast and, after warming to 80° F., 0.5 gm. of ammonium sulfate. The mixture is aerated by means of compressed air for at least two hours, made up to 1,000 cc. and filtered, and the filtrate used for the determination of lactose by the gravimetric copper reduction method.

For the determination of fat, from 200 to 300 gm. of finely ground air-dried bread is digested by boiling for about one hour with 1,000 cc. of distilled water

and 30 cc. of hydrochloric acid. The mash is then filtered through a Buchner funnel after the addition of 10 gm. of Filter-Cel. The residue is stirred with ether and filtered through Filter-Cel into a dry flask. After evaporating the ether the oil is used for determining the Reichert-Meissl number.

The acetic index in the analysis of butter [trans. title], E. SAVINI (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 792-795*).—A brief description is given of the technique of the Fascetti acetic index method of detecting adulteration in butter (*E. S. R.*, 48, p. 13).

Fat in commercial casein, H. JEPHCOTT and N. RATCLIFFE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1271-1276*).—This paper discusses the factors influencing the fat content of commercial casein and the most suitable methods of determining fat in casein.

Fat determinations on separated milk and the whey, wash water, and rennet casein obtained from the milk showed the fat content of the casein to depend almost entirely upon that of the separated milk. Firmness of the curd appeared to affect somewhat the readiness with which the fat was retained by the casein.

A comparison of the Soxhlet, Roese-Gottlieb, Gangolli-Meldrum, and Werner-Schmidt methods of determining fat in rennet and acid casein showed the Werner-Schmidt method to be the most satisfactory. The Soxhlet method extracted only a small percentage of the total fat. Both the other methods gave good results with finely divided acid casein, but failed entirely with rennet casein. With the Werner-Schmidt method consistent results were obtained in all cases.

Chemical and physical methods for the control of saponified cresol solutions, R. M. CHAPIN (*U. S. Dept. Agr. Bul. 1308 (1924), pp. 24*).—This publication discusses the fundamental requirements for saponified cresol solutions to be used for the disinfection of diseased animals and of premises and vehicles which may have been infected by them, and describes a procedure for the physical and chemical examination of such solutions to replace in the plant and control laboratories the previous and more cumbersome method of the author (*E. S. R.*, 20, p. 420).

The factors considered fundamental are summarized in the form of skeleton specifications, and at the close of the publication tentative standards are given as the result of an examination of a number of commercial samples covering a wide range in composition. Placing these tentative standards in the skeleton specifications, the recommendations may be summarized as follows:

(a) The product shall remain a uniform liquid when held at a temperature of 0° C. for 3 hours.

(b) It shall dissolve completely in 30 parts water at a temperature of 25° within 2 minutes, affording a solution entirely free from globules and not more than faintly opalescent.

(c) It shall contain soap, exclusive of excess alkali, equivalent to not less than 3.6 per cent of sodium hydroxide, and the excess alkali shall be equivalent to not more than 0.5 per cent of sodium hydroxide.

(d) It shall contain not less than 50 per cent and not more than 53 per cent total phenols, not more than 7.5 per cent of benzophenol, and not more than 30 per cent of phenols distilling above a temperature of 207°.

The physical tests and chemical determinations to meet these specifications are outlined. The physical tests include the chill test, the solution-rate test, and the solubility degree test, and the chemical the estimation of total fixed alkali, excess fixed alkali, total phenols, and benzophenol. The method for total fixed alkali is based upon the usual method for determining the total

alkali in hard soaps with a preliminary evaporation to expel tar bases and the addition of stearic acid to stiffen the separated fatty acids and cresol. For excess fixed alkali, a modified method employing Poirrier blue C4B as indicator is described. For total phenols a modification of the Weiss-Hill method¹ was developed and is described in detail. The method for benzo-phenol is as essentially noted from another source (E. S. R., 44, p. 10).

"It must be expressly noted that nothing in this bulletin operates to modify in any respect the specifications and requirements which have been issued or which may be issued by regulatory offices of the Bureau of Animal Industry governing products permitted for use in official disinfection."

Utilization of almonds for various food products, A. F. SIEVERS and F. RABAK (*U. S. Dept. Agr. Bul. 1305 (1924), pp. 22 figs. 10*).—The utilization of almonds unsuitable for the unshelled nut trade is the general subject of this publication. In addition to salted almonds and almond paste, several other products not yet on the market are discussed as to preparation, composition, keeping qualities, and general characteristics. These products include almond butter, prepared similarly to peanut butter; almond confection, consisting of a mixture of ground roasted kernels and confectioners' sugar, with the addition of water or fixed oil of almonds to form a paste; and almond powder, a fine mixture of ground kernels and confectioners' sugar, which is considered more convenient than almond paste for the preparation of macaroons. Cost estimates for producing the various products and a description of factory equipment required, with methods of preparation, are included.

METEOROLOGY

Weather reports, C. C. GEORGESON ET AL. (*Alaska Stas. Rpt. 1923, pp. 3, 4, 28-37*).—Monthly summaries of temperature, precipitation, and cloudiness at 36 places in Alaska are given with brief notes on the weather conditions at the experiment stations during the calendar year 1923.

"The season on the whole was favorable, the weather being a little warmer and drier than normal. . . . At the Fairbanks Station the average temperature for May, June, July, and August was 57° F., compared with the 13-year average of 55.2°. The rainfall for the same months was only 3.96 in., compared with an average for the 13 years previous of 6.25 in. At Matanuska the average temperature for the four summer months was 56.6°, while the rainfall was only 3.3 in." The light rainfall was, however, supplemented with moisture from the melting of snows of the previous winter. The growth of straw was shorter than usual, due to lack of rainfall. "The warm summer hastened growth so that even late varieties of grain which seldom ripen in the interior matured in 1923. At the Fairbanks Station the last killing frost occurred May 10, and the first September 23, giving a frost-free period of 135 days, which is 33 days more than the average for 13 years. At Matanuska the last killing frost occurred May 17, and the first September 23, giving 128 consecutive days without frost. The same conditions prevailed in the coast region and other parts of Alaska." Not only grain crops but garden vegetables, small fruits, and flowers matured.

Wheat yield and rainfall in Ohio, F. A. WELTON and V. H. MORRIS (*Jour. Amer. Soc. Agron., 16 (1924), No. 11, pp. 731-749, figs. 9*).—Summarizing and analyzing the available data on this subject, the authors reach the conclusion that "a decrease in rainfall is accompanied by an increase in yield of wheat;

¹ Indus. and Engin. Chem., 15 (1923), No. 8, pp. 799, 800.

subnormal rainfall is more beneficial in the autumn and early spring than in the winter or late spring; November and April are the two individual months in which subnormal rainfall appears to be most beneficial; wheat yields are probably depressed in most years by too much rainfall."

The climate of the Netherlands Indies, V [trans. title], C. BRAAK (*K. Magnet. en Met. Observ. Batavia, Verhandel.* 8 (1924), pt. 5, pp. III+279-341+123-158, pls. 13, figs. 15).—Continuing contributions to this subject previously noted (*E. S. R.*, 51, p. 510), this part deals with temperature and humidity.

It is shown that the dominant factor, temperature, varies mainly with altitude, but also, to a less extent, seasonally and otherwise. It is stated that "the average temperature at the Java stations may be represented approximately by the formula:

$$t=26.3^{\circ}-0.61 h \text{ (in hectometers).}$$

The deviations from the formula . . . are, as a rule, very small; they prove that, in general, the average temperature of any place can be obtained without observations and by calculation only."

"As a rule, the concave land forms (inclosed valleys and plains) increase the daily range, convex forms (projecting ridges and hills) tend to diminish it. The influence of the sea has a strong damping effect on the temperature extremes. The highest values are observed on high inclosed areas; outward and inward radiation attain high values there, whereas the interchange with the air of the free atmosphere occurs still chiefly in the same way as above the plains, viz, by vertical convection. At the border of the plateaus and still more at the outside slopes of the mountains, the interchange of air with the free atmosphere is much stronger, occurring also by horizontal air movement; consequently the diurnal ranges of temperature become smaller."

Rapid and large falls of temperature follow showers. Freezing temperatures never, or rarely, occur on the unsheltered mountain tops, but frosts occur on the inclosed plateaus and in the valleys. Drought favors night frost not only by increasing outward radiation, but in another way: "When the humidity is so high that the dew point is reached before the temperature has fallen to zero, condensation sets in, checking the cooling, whereby dew or fog occurs, and the occurrence of night frost is checked." Ordinary frost protection measures are considered impracticable. Planting of shade trees and drainage afford a certain measure of protection.

In observations on the temperature of the soil at different depths in grassland, it was found that "the temperature at a depth of 3 cm. is about 3° C. higher than the air temperature; it increases at first with depth, but remains practically constant from 10 or 15 cm. to 110 cm." Daily variations in temperature practically disappear at a depth of 60 cm. Observations under asphalt showed temperatures considerably higher than under grass.

SOILS—FERTILIZERS

The chemical composition of soil colloids, W. O. ROBINSON and R. S. HOLMES (*U. S. Dept. Agr. Bul.* 1311 (1924), pp. 42).—Studies are reported on the composition of soil colloidal matter which can be brought into a finely dispersed condition in water. Analyses are given of the colloidal matter isolated from 45 soils representing important agricultural types in the United States and covering wide ranges of composition, exclusive of peats and laterites.

The colloidal matter was found to be composed mainly of silica, alumina, iron oxide, and water, with smaller amounts of lime, magnesia, potash, soda,

phosphorus, manganese, sulfur, chlorine, and organic matter. There was a rather wide variation in the proportions of these constituents present in different colloids, although a considerable number of the colloids showed an almost constant composition. In general, the sum of the lime, magnesia, potash, and soda was low when the silica was low and high when the silica was high. Silica and alumina usually varied inversely.

The colloidal matter from the soil and corresponding subsoil was much alike in composition. The composition of the colloidal matter differed from that of the total soil in being high in alumina, iron, water of combination, organic matter, magnesia, phosphorus, and sulfur, and lower in silica. There was the same general difference in composition between the colloidal matter and the coarser mineral particles that there was between the colloidal matter and the soil, but the difference was more pronounced. The part of colloidal matter which was most readily dispersed was fairly representative in composition of all that it was possible to isolate. In some cases, however, the colloidal matter first dispersed differed considerably from the small part that was obtained toward the end of the extraction process.

The extent of the leaching to which the colloids were exposed is considered to be probably the most important cause of the variations in their compositions. Other factors, such as composition of the parent material, character of the leaching, and enrichment, probably also produced variations. The present rainfall was not always a reliable indication of the extent to which leaching had taken place, although in general soil colloids developed in humid climates showed the greatest effects of leaching. Red or yellow colloids showed the effect of more profound leaching than gray or black colloids.

The colloidal matter of soils was found to be made up chiefly of the products of the chemical weathering of soil-forming minerals. It contained, however, small amounts of fine mineral fragments, and some colloids contained more of these mineral fragments than others. The colloidal matter behaved as a very intimate mixture, and strongly resisted separation into fractions of different composition. It is considered probable that separate particles of different composition do not exist in the colloidal matter of soils.

The lime, soda, potash, magnesia, and silica were extracted more easily from soil colloids by water than the alumina and iron, although the colloidal matter held all of the constituents with great tenacity. Lime and soda were extracted somewhat more easily than potash and magnesia. Digestion with dilute acids removed the red or yellow colors from soil colloids. There were indications of two forms of iron in soil colloids—one a red or yellow hydrous iron oxide and the other some colorless combination, probably a silicate.

Stoichiometrical calculations showed that all the silica, alumina, iron, and water in the colloidal matter were not present in the proportion to form the more common hydrated silicates of alumina and iron, such as kaolinite and nontronite. It is considered possible, however, that some or a considerable part of these constituents may be present in compounds of the composition of such minerals as kaolinite, nontronite, halloysite, or pyrophyllite.

Neutral salt decomposition by colloids [trans. title], W. HÜMMELCHEN and H. KAPPEN (*Ztschr. Pflanzenernähr. u. Düngung*, 3 (1924), No. 5, Wiss., pp. 289–322).—Studies are reported which established the decomposition of neutral salts by humus acids and so-called hydrated manganese peroxide. Such decomposition was influenced by the factors time, concentration, volume of the solution, quantity of adsorbent, and dilution, temperature, and cations of the neutral salt solution. The influence of temperature increase and dilution of the salt solution was especially marked.

The only difference between the actions of the manganese compound and the humus acids was in the different influence of the anions on the decomposition of neutral salts. Both materials fixed small quantities of free bases completely and irreversibly. With high base concentrations the fixation was incomplete and partially reversible and was strengthened by the addition of neutral salts. The products of the decomposition of neutral salts and of base fixation indicated an exchange of ions.

Free acids were loosely adsorbed in a completely reversible state by both humus acids and the manganese compound. The adsorption of sulfuric acid was greater than of hydrochloric or nitric acids by both substances. The adsorption of acids was not increased by the addition of neutral salts. No decomposition of neutral salts by silicic acid or iron hydroxide could be demonstrated analytically.

Soil survey of Crenshaw County, Alabama, J. F. STROUD ET AL. (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+375-407, fig. 1, map 1).—This survey, made in cooperation with the Alabama Department of Agriculture and Industries, deals with the soils of an area of 387,200 acres lying in the Coastal Plain region in southern Alabama. The surface of the county varies from flat, undulating, gently rolling, or rolling, to hilly and broken. All of the county, except the first bottoms and some of the flatter and lower lying second bottoms, is well drained.

The soils are prevailing light in color and are decidedly deficient in organic matter. They are all practically neutral or slightly acid, and range in texture and structure from loose sands to heavy clays in both the soils and subsoils. Including meadow and swamp, 25 soil types of 15 series are mapped, of which the Ruston fine sandy loam is the most extensive individual type.

Mason County soils, R. S. SMITH, E. E. DETURK, F. C. BAUER, and L. H. SMITH (Illinois Sta. Soil Rpt. 28 (1924), pp. [2]+62, pls. 2, figs. 9).—This survey deals with the soils of an area of 354,554 acres lying west of the central part of Illinois. A large part of the area was originally poorly drained, and apparently much of this has been reclaimed by artificial drainage channels.

The soils are grouped as upland prairie, upland timber, terrace, and swamp and bottomland soils. Thirty-six soil types are mapped, of which the brown sandy loam and dunesand terrace soils cover 22.89 and 20.54 per cent of the area, respectively. Data on the plant nutrient content of the different soil types are presented, together with information on their fertility requirements and crop adaptations.

Information on the interpretation of the soil survey and on the general principles of soil fertility is appended, and a supplement containing experimental field data on four different important soil types is included.

Soil survey of Mississippi County, Missouri, W. DEYOUNG and R. WILDERMUTH (U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+551-582, figs. 2, map 1).—This survey, made in cooperation with the Missouri Experiment Station, deals with the soils of an area of 269,440 acres forming a part of the Mississippi lowland in southeastern Missouri. The topography is flat to faintly undulating. In general the county has two distinct topographic divisions, namely, the high second bottoms, or sandy area, and the lower first bottoms, or heavy soil area. Approximately four-fifths of the county, comprising the lower area outside the limits of the sandy belt and including a narrow belt of light soils along the river, is known as the bottoms or black soils region. The northern half of the county is fairly well drained, but it is stated that the southern half needs more drainage before much of the land can be farmed successfully.

The soils of the area belong with the first and second bottom, or terrace soils, of the Mississippi River and represent comparatively recent deposits of alluvium. Including riverwash and muck, 29 soil types of 8 series are mapped, of which the Sharkey clay and silty clay loam cover 23.3 and 11.5 per cent of the area, respectively.

Soil survey of Spartanburg County, South Carolina, W. J. LATIMER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+409-449, fig. 1, map 1*).—This survey deals with the soils of an area of 524,160 acres lying in the Piedmont Plateau in northwestern South Carolina. Physiographically the region is a plateau dissected by numerous streams. The low inter-stream ridges are nearly flat to undulating or rolling, becoming somewhat broken along the streams. Practically all the upland is thoroughly drained.

The soils of the area are of residual or alluvial origin. Including meadow, 18 soil types of 8 series are mapped, of which the Cecil sandy clay loam, sandy loam, and clay loam cover 39.9, 32.2, and 12.7 per cent of the area, respectively.

The soils of Tennessee and their future needs, C. A. MOOERS (*Tennessee Sta. Rpt. 1923, pp. 5-14*).—A discussion and tabular data are presented in an attempt to put into definite form the general soil situation of the State, with special reference to the future needs.

Chemical analyses and fertility of West Virginia soils, O. C. BRYAN and E. P. DEATRICK (*West Virginia Sta. Bul. 184 (1924), pp. 27, fig. 1*).—In a continuation of studies previously noted (*E. S. R.*, 36, p. 722; 40, p. 420), data on the nitrogen, phosphorus, potassium, and carbon content and the lime requirement of 485 samples of soil, representing the important soil series in West Virginia, are reported and discussed.

The analyses indicate that soils derived from sandstone and shale have lower contents of nitrogen and phosphorus than soils derived from limestone, and are more acid and less fertile. In this connection it was found that the sandstone and shale soils require an average of 3,000 lbs. of lime per acre to neutralize their acidity. The nitrogen content was found to be in proportion to the organic carbon in all of the soils, representing about from 8 to 10 per cent of the carbon. All of the soils were found to contain an average of 1 per cent or more of potassium. A fairly good correlation was established in all the soils between the nitrogen, phosphorus, and carbon contents, the lime requirements, and fertility. Most of the sandstone and shale soils, comprising over 80 per cent of the soils of the State, were found to respond to treatments of acid phosphate, nitrates, manures, and lime.

Composition of forest soil [trans. title], A. NĚMEC and K. KVAŘIL (*Compt. Rend. Acad. Sci. [Paris], 179 (1924), No. 11, pp. 537-539*).—Continuing previous work (*E. S. R.*, 49, p. 511), the results of a brief study of the reaction and organic matter and nitrogen contents of the different strata of spruce, pine, and oak forest soils are briefly reported.

All strata of the spruce soils were acid. The oak soils were much less acid than the spruce soils, the reactions throughout being almost neutral. The reactions of the different strata of pine soils varied considerably, the lower strata being alkaline. The more acid strata of pine soils were relatively rich in nitrogen and organic matter.

Survey of the soils of the lowlands of southern Tegal [trans. title], J. T. WHITE (*Arch. Suikerindus. Nederland. Indië, 32 (1924), No. 27, pp. 637-664, figs. 4*).—This survey deals with the geology, petrography, and mechanical and physical properties of the soils of a lowland area in the southern Tegal residency in Java, and comments on the agricultural value of these soils.

These soils are prevailing laterites and loams. The former are said to possess good mechanical and physical characteristics and to be well supplied with phosphoric acid. The loam soils, on the other hand, possess less favorable physical and mechanical characteristics and are deficient in phosphoric acid.

Soil moisture investigations in Canada, E. S. HOPKINS (*Sci. Agr.*, 5 (1924), No. 3, pp. 79-83).—In a contribution from the Central Experimental Farm, Ottawa, the plans for soil moisture investigations being undertaken in different parts of Canada are described. Some of these have already indicated that the soil mulch may not be effective in conserving moisture, and that weeds remove a large amount of moisture.

The response of plants in soil- and in water-culture to aeration of the roots, R. C. KNIGHT (*Ann. Bot. [London]*, 38 (1924), No. 150, pp. 305-325, fig. 1).—Studies conducted at the Imperial College of Science and Technology, London, are reported.

The results showed an increase in the dry weight of maize in soil culture if the soil was aerated. The carbon dioxide content of the atmosphere of a loam soil increased rapidly if the soil was in a sealed pot, reaching 1 per cent in 2 hours and 34 per cent in 23 days. In water culture, maize failed to respond to aeration of the nutrient solution. Other plants showed a considerable increase in dry weight as the result of aeration.

Ammonification of amine nitrogen by soil microsiphones [trans. title], G. GUITTONNEAU (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 10, pp. 512-514).—Experiments are reported which demonstrated the phenomenon of the ammonification of the nitrogen of acid amines by soil microsiphones, previously described (*E. S. R.*, 51, p. 416). However, the four acid amines studied were not attacked with equal facility by these organisms. Certain species seemed to be adapted to certain of the acids, and it is tentatively concluded that this adaptation relates to the nature of the ternary carbon products.

Utilization of mineral nitrogen by soil microsiphones [trans. title], G. GUITTONNEAU (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 16, pp. 788-790).—Studies are reported which showed that the soil microsiphones frequently assimilate nitrous, nitric, and ammonia nitrogen, especially the last. It is shown, however, that the nature of the carbonaceous material used in the culture medium is the most important factor in such assimilation.

Intensity of assimilation of atmospheric nitrogen by forest soils [trans. title], A. NĚMEC and K. KVAPIL (*Bul. Soc. Chim. Biol.*, 6 (1924), No. 6, pp. 515-520).—Studies of nitrogen fixation in the humus and mineral strata of different forest soils are briefly reported.

The results showed that in dense spruce and pine soils nitrogen fixation is greater in the top stratum containing much humus and organic matter from decayed leaves than in the mineral strata or in adjacent mineral soils. In fact the mineral forest soils seemed to suffer a loss of nitrogen due to denitrification. In clean pine, spruce, and birch forests of long standing, nitrogen fixation was less intense in the organic than in the mineral soils.

The seasonal variation of nitrates in the black turf at Onderstepoort, D. J. R. VAN WIJK (*Jour. So. African Chem. Inst.*, 7 (1924), No. 2, pp. 38-46, figs. 4).—Studies of the seasonal variation of nitrates in certain South African soils are reported, indicating that such variations as there are in the nitrate content seem to be more related to the moisture present than to any other cause, seasonal or otherwise.

Data on the average nitrates for the first foot over a period of 27 months showed that these amounts are roughly inversely proportional to the corresponding amounts of moisture. It is believed that there is a kind of equi-

librium between the extent of nitrate formation in this virgin soil and the corresponding moisture content. No particular rise of nitrates was found during the winter months either in virgin or cultivated soil, but a rapid rise was found after the soil had been dug over and had been lying bare for over 8 months. This rise took place at the end of the summer when there was no question of low temperature.

The detrimental effect of cereal straw on plants (*New York State Sta. Rpt. 1924, pp. 20, 21*).—The progress results of studies on the subject are said to indicate that certain nitrogen additions to straw, together with moisture maintenance, will rot the material down into a product closely resembling rotted manure and in which the detrimental effect of the straw on plants has completely disappeared.

Nitrogen fertilization of meadows [trans. title], F. LANG and L. F. KUCHLER (*Ztschr. Pflanzenernähr. u. Düngung, 3 (1924), No. 10, Wirtschaft.-Prakt., pp. 393-433*).—The results of a 3-year fertilizer study on meadow are reported.

The use of heavy nitrogen additions caused marked increases in hay yields up to 70 per cent, the best results being obtained from applications of from 100 to 150 kg. of nitrogen per hectare (89 to 133.5 lbs. per acre).

The form of nitrogen used was quite important. Ammonium sulfate had a rapid and sure fertilizing effect. Lime nitrogen was also effective when used before seeding on soils deficient in lime. The best results were obtained from lime nitrogen applied in the winter and from ammonium sulfate in the spring and after cutting the hay.

Nitrogen fertilization increased hay yields during dry seasons. There was no residual action from nitrogen fertilization. Heavy nitrogen fertilization depressed the legumes, and heavy applications of ammonium sulfate did not result in an injurious acidity of the soil.

It is concluded that if the meadow flora is essentially changed by too frequent nitrogen fertilization, there should occasionally be a year during which no nitrogen is applied but in which heavy applications of potash and phosphoric acid are made, especially if a greater legume flora is desired.

Top-dressing grassland in peat soil with Chilean nitrate [trans title], H. WITTE (*Svenska Mosskulturför. Tidskr., 38 (1924), No. 1, pp. 33-38*).—Studies on top-dressing grassland in peat soil with Chilean nitrate are reported, showing a substantial gain at prevailing prices of hay and manure. Top-dressing with Chilean nitrate did not decrease the percentage of hay but decreased its clover content. Timothy was benefited both in amount and quality.

The effect of cyanamid and related compounds on the number of micro-organisms in soil, F. E. ALLISON (*Jour. Agr. Research [U. S.], 28 (1924), No. 11, pp. 1159-1166*).—Studies conducted at the U. S. D. A. Fixed Nitrogen Research Laboratory on the effect of commercial cyanamid and related compounds on bacterial numbers in soil are reported.

The results showed that cyanamid produced unusually large increases in the number of bacteria in soils, the maximum increase usually occurring within two weeks after application, depending upon the rate of application and the temperature of incubation. Both the cyanamide and the lime contents of the commercial product were found to be primarily responsible for this rapid bacterial multiplication. Where used alone either calcium hydroxide or calcium oxide in amounts equivalent to that found in cyanamid produced large increases in bacterial numbers. The larger the application the larger was the stimulation within the limits of these experiments. In the case of pure cyana-

mide the lower rates of application produced relatively small increases and the highest rates partially sterilized the soil. On the other hand, the intermediate rate produced a very large increase comparable to commercial cyanamid. It is considered impossible, therefore, to state whether lime or cyanamide is the greater factor in explaining the effects of commercial cyanamid.

Urea and ammonium sulfate produced only slight effects upon bacterial numbers, even though both materials are known to be excellent sources of plant nutrients. Dicyanodiamide, guanylurea sulfate, guanidine nitrate, and biguanide nitrate also failed to produce marked effects.

Fertilizers containing nitrogen and phosphoric acid produced by treating superphosphate with ammonia [trans. title], A. H. M. ANDREASEN and P. E. RAASCHOU (*Nord. Jordbrugsforsk.*, 1924, No. 4, pp. 285-304, figs. 2).—An account is given of experiments on the manufacture of fertilizers containing nitrogen and phosphoric acid by treating superphosphate with ammonia.

It was found that the presence of gypsum in superphosphate influenced the duration of the reaction in the presence of water. Several factors were found to influence the degree of solubility of the phosphoric acid in the product. For instance, when the process is conducted at low temperature and with dried superphosphate a product may be obtained containing about 7 per cent of water-soluble ammonia and from 18 to 19 per cent of phosphoric acid, of which from 96 to 98 per cent is soluble in citrate solution and a considerable percentage in water.

The nitrification of phosphorus nitride, F. E. ALIISON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 11, pp. 1117, 1118).—Experiments conducted by the U. S. D. A. Fixed Nitrogen Research Laboratory are briefly reported, indicating that the nitrogen in phosphorus nitride is not readily converted into nitrates.

The influence of the admixture of different grades of limestone on the solubility of phosphoric oxide in superphosphate, T. D. HALL and J. C. VOGEL (*Jour. So. African Chem. Inst.*, 7 (1924), No. 2, pp. 14-25).—Studies to determine the extent and speed of the reversion of the water-soluble and citrate-soluble phosphoric acid in superphosphate when mixed with limestone of different grades are reported.

The results showed that in every mixture caking occurred soon after mixing, indicating that the chemical action started immediately, due mainly to the presence of free acid. The mixtures of fine limestone with superphosphate reverted rapidly during the first week and then the reversion stopped, leaving about half the water-soluble phosphoric acid unaltered. An immediate total reversion took place in mixtures of superphosphate and slaked lime, and the water-soluble phosphoric acid was converted into citrate-soluble phosphoric acid. The reversion was immediately complete even when no excess of lime was added. A mixture of equal parts of basic slag and superphosphate set hard in six hours, indicating that a reaction occurred immediately.

The results of similar experiments by others are discussed.

The utilization of potassic rocks [trans. title], A. MESSERSCHMITT (*Gior. Chim. Indus. ed Appl.*, 6 (1924), No. 9, pp. 431-434).—Data are briefly presented on different uses of potassium-bearing rocks for the production of fertilizer materials.

It has been found that the potash contained in volcanic rocks can be utilized by mixing such rocks with mineral phosphates and heating to 1,250° C. (2,282° F.). By this process a fertilizer containing potash and phosphoric acid is obtained which has an alkaline reaction and is said to be soluble in citric acid and water. Heating of leucite with a solution of a sodium salt has also been found to be a feasible process. For example, a mixture of leucite with sodium

nitrate results in potassium nitrate, which is said to crystallize from a concentrated solution on cooling. A complete fertilizer has been obtained by mixing such potassium nitrate with a fertilizer containing potash and phosphoric acid.

Influence of sulfur oxidation on solubility of soil minerals, R. E. STEPHENSON and W. L. POWERS (*Soil Sci.*, 18 (1924), No. 4, pp. 317-321).—Pot studies conducted at the Oregon Experiment Station to determine the influence of sulfur oxidation on the solubility of the essential plant elements in an arid neutral sandy loam and a humid acid silt loam soil are reported.

Even the lighter applications of sulfur increased the acidity, and it is concluded that the long continued use of sulfur on soils already slightly acid will cause some injury unless neutralized with lime. It was found further that the flocculating effect of oxidized sulfur may be of considerable value under certain conditions.

Further researches and considerations regarding the action of manganese on vegetation [trans. title], G. D'IPPOLITO (*Staz. Sper. Agr. Ital.*, 56 (1923), No. 7-9, pp. 386-400).—Studies on the influence of 5 per cent solutions of oxalic, tartaric, acetic, citric, malic, hydrochloric, sulfuric, and nitric acids, and of distilled water on the manganese content of soil, sand, vegetable charcoal, and pyrolusite are reported.

Acetic acid gave a positive reaction for manganese with all four materials, while tartaric gave a slightly positive reaction with the sand and soil only. Oxalic acid gave an intensely positive reaction with sand and pyrolusite, a feeble reaction with soil, and no reaction with charcoal. All the other acids and the distilled water were inactive.

These results are taken to indicate that manganese was present in these materials only in the oxide and silicate forms, being in the silicate form in charcoal, and that manganese silicate is not soluble in the organic and inorganic acids used. It is concluded that fertilization of soils with manganese dioxide is unnecessary where that form of manganese is already present, but that it should be advantageous on soils containing manganese exclusively or mainly in the form of silicates.

Pot tests with wheat sprouts in charcoal, river sand, and ordinary soil to which manganese was added as the dioxide and sulfate and field tests with wheat indicated a generally beneficial influence of manganese.

The results obtained by these tests are taken to indicate that the beneficial action of manganese is catalytic in nature rather than directly chemical, and relates to the stimulation of the diastatic properties of vegetation.

Commercial fertilizers, R. H. ROBINSON (*Oregon Sta. Circ.* 58 (1925), pp. 20).—Guaranties and actual analyses of 66 samples of fertilizers and fertilizer materials collected for inspection in Oregon during the season 1923-24 are presented and discussed, together with general information on the selection, purchase, and use of commercial fertilizers, a brief reference to the Oregon lime control law, and tabular data on the different brands and compositions of gypsum and limestone sold in the State in 1924.

Commercial fertilizers in 1923-1924, G. S. FRAPS and S. E. ASBURY (*Texas Sta. Bul.* 322 (1924), pp. 3-61).—Guaranties, actual analyses, and valuations of 917 samples of fertilizers and fertilizer materials collected for inspection in Texas during the season 1923-24 are reported, together with a list of brands registered for sale in the State during the season.

A guide for fertilizer users, M. E. MCCOLLAM (*Western Washington Sta. Bimo. Bul.*, 12 (1925), No. 5, pp. 98-104).—Brief practical information on the use of fertilizers and manures in Washington is presented.

AGRICULTURAL BOTANY

Physiological aspects of germination, V. H. BLACKMAN (*Jour. Inst. Brewing*, 29 (1923), No. 10, pp. 819-824).—The author deals briefly with some of the rather special aspects of germination, including the physiological condition of the dormant seed, as evidenced by tests under extreme or at least very unusual conditions of exposure to poisons, cold, and heat at different moistures for different periods, and in different conditions as regards perviousness of the seed coats.

Citing cases variously reported, the author holds that "seeds such as these, if they are respiring at all during these resting periods in the dry state, are carrying on purely anaerobic respiration within the impervious seed coats. The loss of germinating power after many years is not due to loss of material in respiration. The respiration is so small at low temperature that a seed in a thousand years would not lose a considerable part of its material. The loss of it must be due no doubt to slow changes in the proteins, probably to denaturing of the protein. . . . A supply of water and of air are the two external conditions generally necessary for the germination of seeds."

As to the physiological changes occurring in the seed at germination, so-called dormancy only is dealt with, but in several of its aspects, including the artificially induced dormancy following exposure to carbon dioxide of fairly high concentration.

The structure and development of the seed coat and cause of delayed germination in *Melilotus alba*, J. N. MARTIN (*Abs. in Iowa Acad. Sci. Proc.*, 29 (1922), pp. 345, 346).—"The epidermis of the ovules forms the much elongated cells known as the Malpighian cells of the seed coat. The outer walls of the Malpighian cells are much thickened and are composed of layers differing in physical properties. One of these layers is the light line which in most seeds is impervious to water until it is modified by weathering or by some artificial means. The light line is apparently only more compact cellulose, for it hydrates quickly in water at 80° C. and then gives a distinct cellulose reaction and is permeable to water.

"The action of the weather on seeds lying out over winter is to open the line and thus permit the embryos of the seeds to obtain water."

Germination studies of some shrubs and trees, L. H. PAMMEL and C. M. KING (*Iowa Acad. Sci. Proc.*, 29 (1922), pp. 257-266, figs. 14).—A study has been made by the botanical department of the Iowa State College regarding the germination of *Quercus gambellii*, *Pasania densiflora*, *Maclura pomifera*, *Prunus caroliniana*, *Rhus toxicodendron*, *R. canadensis*, *Gleditsia aquatica*, *Rhamnus californica*, *R. tinctoria*, *Lycium halimiflorum*, and *Shepherdia argentea*. Descriptions are given of the seedlings of these plants, with an account of the conditions under which the seeds germinated.

Comparative studies on respiration, XXIV-XXVII, G. B. RAY (*Jour. Gen. Physiol.*, 5 (1923), Nos. 4, pp. 469-477, figs. 5; 5, pp. 611-622, figs. 7; 623-627, figs. 3; 6, pp. 741-748, figs. 3).—Four papers are included.

XXIV. *The effects of chloroform on the respiration of dead and of living tissue*.—In order to throw some light on the action of anesthetics on the oxidations of the living cell, the author has made experiments on living and dead tissue. The organism chosen was the green marine alga, *Ulva lactuca latissima* (sea lettuce), which is readily obtainable at various seasons, and consists of but two layers of cells, so that its gaseous exchange is rapid. A drawback which is the result of its habitat, namely, that the plant grows in rather stagnant water and is very much contaminated with bacteria, was in part obviated by washing the plant in running sea water for 24 hours before use.

"Chloroform in low concentration (0.25 per cent) causes an increase in the rate of production of CO_2 in *Ulva*; this is followed by a decrease. In higher concentration (0.5 per cent), only a decrease is observed. Assuming that the normal oxidation depends on the action of peroxide and peroxidase, experiments were made by placing [*U. lactuca latissima*] in 1 per cent H_2O_2 and in $\text{Fe}_2(\text{SO}_4)_3$ (which acts like a peroxidase). The former diminishes the rate, the latter increases and subsequently decreases it. When *Ulva* is killed in such a manner as to destroy the oxidizing enzymes, no CO_2 is produced unless H_2O_2 and $\text{Fe}_2(\text{SO}_4)_3$ are present. If to this mixture chloroform is added, the effect depends on the concentration of the iron. If the concentration is low there is an increase in the production of CO_2 followed by a decrease. If the concentration is high the rate appears to decrease from the start."

XXV. *The action of chloroform on the oxidation of some organic acids.*—Experiments similar to those described in the preceding paper were undertaken, various organic acids being used in place of killed *Ulva*.

"Organic acids when treated with H_2O_2 and $\text{Fe}_2(\text{SO}_4)_3$ produce CO_2 at a rate that can be measured by the indicator method. In the case of acids containing a double bond, the rate of production of CO_2 can be varied by the addition of an anesthetic. The changes in the rate of production of CO_2 under the influence of a typical anesthetic, such as chloroform, show a striking resemblance to the reaction of the organism."

XXVI. *The production of CO_2 from organic acids in relation to their iodine absorption.*—This paper is a report of the changes in the iodine absorption of the compounds affected by the action of chloroform, as compared with the rate of production of CO_2 . The technique used in the experiments is described.

A definite relation between the rate of production of CO_2 and the ability of the compound to absorb iodine is believed to have been established.

XXVII. *The mechanism of oxidation in relation to chloroform anesthesia.*—"A mathematical analysis of the effects of chloroform on the production of carbon dioxide by living *Ulva*, killed *Ulva*, and unsaturated organic acids indicates that the same process is taking place in all three cases. On the basis of this interpretation it is reasonable to conclude that the action of chloroform on the oxidative mechanism of the cell is chemical in nature, and that it acts either by catalysis or by the formation of a loose compound with some portion of the system."

To the question of stomatal regulation of plant's transpiration [trans. title], E. A. ZHEMCHUZHNIKOV (GEMTCHOUGENIKOV) (*Izv. Opytn. Dona i Sev. Kavkaza (Jour. Agr. Research Don and North Caucasus)*, No. 1 (1922), pp. 29-39).—A study of the rôle of stomata in connection with transpiration was made, employing sunflower, maize, and sorghum in soil at 60 per cent of complete saturation. The curves of transpiration paralleled usually but not always those for stomatal aperture, which was found to be greatest at midday with the leaves well exposed to sunshine. In general, the results indicate a connection between stomatal aperture and transpiration, though meteorological factors are probably also influential. Stomata of sunflower open several times more widely than do those of maize and sorghum.

Quantitative estimation of aeration in leaves, F. M. ANDREWS (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 268-270).—The author has made experiments with a number of plants which allow the passage of air with marked ease through their stomata. Among such favorable plants are mentioned *Nymphaea* sp., *Funkia* sp., *Calla aethiopica*, *Arum maculatum*, and *Rumex* sp. With such plants also is said to belong *Myriophyllum proserpinacoides*, which is cultivated in aquaria.

Some wound responses of foliage leaves, R. B. WYLIE (*Iowa Acad. Sci. Proc.*, 29 (1922), pp. 238-244, figs. 6).—The work of foliage leaves necessitates a structure involving liability to mechanical injury, also to animal attack. The ability of plants to deal with conditions set up by accidents which are frequent in summer appears to be due to ability to restore rapidly an injured cortex.

To determine the nature of the healing tissues employed, wounded leaves were collected in early September from a number of plants, the injured areas were cut out, together with a margin of normal blade, and the pieces prepared for sectioning. In this preliminary report are recorded the conditions found in *Salvia officinalis*, *Lonicera sullivantii*, *Bryophyllum* sp., *Trifolium pratense*, *Nasturtium armoracia*, and *Pittosporum* sp.

Cicatrization in plant tissues after freezing [trans. title], W. RUSSELL (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 339-342, fig. 1).—The formation of ice in plant stems ordinarily occurs in two principal regions, the periphery of the bark and the central part of the pith; though if the cold be intense and the cells contain much water, ice may form in all the tender parenchyma and much harm to the plant may result. Cases of slow or partial freezing are noted in connection with subsequent self-reconstruction by the cells and tissues.

The effect of pressure on growth, F. M. ANDREWS (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 265, 266).—Experimentation is briefly detailed as testing the effects on plant growth of mechanical pressure (combined in some cases with centrifugal force). Recovery was generally complete, though sometimes delayed in proportion to the intensity of the pressures, which ranged from less than that of a 30-meter column of water up to pressures having intensities of 50, 100, 200, 400, and 600 atmospheres. Pressures of 1,000 and of 8,000 atmospheres are mentioned.

Growth of potato plants in sand cultures treated with the "six types" of nutrient solutions, E. S. JOHNSTON (*Maryland Sta. Bul.* 270 (1924), pp. 53-86, figs. 8).—The results are given of a study of the proportions of nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium in six solution types that gave the best growth of potato plants in sand cultures. It was found that the best growth usually occurred for cultures receiving the greater proportions of nitrogen. When nitrogen was united with magnesium the ill effects of high concentrations of the latter seemed to offset the good effects of high nitrogen concentrations.

The atomic proportions of nitrogen, phosphorus, and potassium, considered as unity, correlated with the best cultures were found to be approximately 44, 22, and 33 per cent, respectively. Attention is called to the fact that the proportions of these elements, considered as a unit, are practically the same as those recommended in Maryland for early potatoes in sandy soil.

The salt requirements of Marquis wheat in water culture for the vegetative phase of development, R. P. HIBBARD and S. GERSHBERG (*Michigan Sta. Tech. Bul.* 64 (1924), pp. 3-28, figs. 7).—A report is given of experiments conducted to determine the salt requirements of Marquis wheat during its vegetative phase of growth. This growth phase is an arbitrary one, extending from five weeks after the end of the germinating phase until the appearance of flowers in control lots. A large number of combinations of monobasic potassium phosphate, calcium nitrate, and magnesium sulfate were used in water cultures, and the effect on the growth of the wheat was noted.

Culture solutions high in magnesium sulfate and relatively low in both calcium nitrate and potassium phosphate produced the best growth of Marquis wheat during the vegetative period in water cultures in the greenhouse under

the conditions of the experiment. The poorest cultures were those that were relatively low in magnesium sulfate. The authors found that comparing the dry weight of the tops was as reliable a method of determining salt requirements of plants as was that of the dry weight of the entire plant. In general, the greatest dry weights were correlated with the largest and tallest top growth and the best yields of green tops.

Alkaline reaction of the cotton plant, F. B. POWER and V. K. CHESNUT (*Science*, 60 (1924), No. 1557, p. 405).—In a previous article by Mills (E. S. R., 52, p. 427), attention was called to the alkaline reaction of the lower side of the leaves, tender buds, and young stems of the cotton plant.

The authors have been engaged for some time on a study of the chemistry of the cotton plant, and on the above point they give a preliminary report. They believe that the alkalinity of the dew of the cotton plant is attributable, at least in part, to the presence of ammonia and trimethylamine, both of which have been determined in the plant, and they are considered as emanations from it.

Radioactivity of ripe tomatoes, C. F. LANGWORTHY (*Science*, 60 (1924), No. 1557, pp. 405, 406).—A report is given of an examination of the radioactivity of pulped tomato fruits, comparisons being made with Washington, D. C., city water, the radioactivity of which is known.

Several examinations of the same material were made at intervals of about a week, and the radioactivity, though relatively small, was pronounced, being more than three times as great as that of the city water. It was also apparent that the amount diminished as time passed.

The evolution of plastids in plants [trans. title], L. EMBERGER (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 330-333, figs. 6).—It has become known, as a result of research reported by the author (E. S. R., 45, p. 30), by Mangenot (E. S. R., 45, pp. 30, 31), and by Guilliermond (E. S. R., 46, pp. 823, 824), that two kinds of mitochondria exist in the cells of all green plants. One of these structures appears identical with the plastids, the functions of the other remaining as yet obscure. The appearance and development of the plastids in the Equisetaceae are described in the present article.

Cases of teratology in plants [trans. title], F. CHASSIGNOL (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 356-358).—Cases are described showing fasciation, duplication, proliferation, or albinism.

[General studies in bacteriology at the New York State Station] (*New York State Sta. Rpt.* 1924, pp. 23-25).—A brief account is given of the general bacteriological investigations carried on by the division of bacteriology. These embrace studies on the Coccaceae, the results of which are noted below; a study of the red chromogenic bacteria, especially *Serratia marcescens*; and on the standardization of biological stains. It is said that as a result of the work of the committee of the American Society of Bacteriologists there are now a number of certified stains available for biological work.

Studies on the Coccaceae, I-V, G. J. HUCKER (*New York State Sta. Tech. Buls.* 99 (1924), pp. 3-44; 100, pp. 3-83, fig. 1; 101, pp. 3-47; 102, pp. 3-46; 103, pp. 3-19).—Five studies on the Coccaceae, in cooperation with Yale University, are reported as follows:

I. *Previous taxonomic studies concerning the genera of the Coccaceae*.—A review is given of the earlier systems of classification, and the validity of the various generic and subgeneric names is discussed.

II. *A study of the general characters of the micrococci*.—The results are given of the correlation of 316 representative strains of the *Micrococcus-Staphylococcus* group, which are said to indicate that there are no apparent

natural division lines by which this group can be separated into two or more genera. A study of the group shows that chromogenesis, nitrate reduction, ability to utilize ammonium salts as an only source of nitrogen, gelatin liquefaction, and action on milk are tests whereby the natural species of the group can be separated, while the fermentation of sugars, gram reaction, habitat, hemolysis of blood, diastatic action, and oxygen requirements are characters less useful in the classification of the micrococci.

III. *The nitrogen metabolism of the micrococci.*—A study of 12 representative strains of micrococci are said to indicate that the nitrogen requirements are very similar for all members of the group. All of the cultures had the power to utilize peptone and complex polypeptide fractions of commercial peptones, while various nondialyzable fractions were not available in the absence of fermentable carbohydrates. Many of the cultures had the power to produce biuret-giving substances in the medium, when grown with ammonium phosphate and biuret-free digested proteins as the only source of nitrogen.

IV. *The classification of genus Micrococcus.*—The species of micrococci, staphylococci, and rhodococci are all placed in the genus *Micrococcus*, and only 16 species are recognized as follows: *M. luteus*, *M. varians*, *M. flavus*, *M. conglomeratus*, *M. citreus*, *M. albus*, *M. candidus*, *M. epidermidis*, *M. tetragenus*, *M. ureae*, *M. freudenreichii*, *M. casei*, *M. aureus*, *M. aurantiacus*, *M. roseus*, and *M. cinnebareus*. A key is given for the determination of the species, and the synonymy of more than 450 specific names is indicated.

V. *Serological studies of the micrococci.*—Studies of a number of representative cultures of the genus *Micrococcus* are said to indicate that from the standpoint of agglutination, agglutination absorption, and complement fixation the various species of the micrococci are serologically distinct. It was found impossible, however, to arrange the species into definite serological groups.

Extensive bibliographies of literature are given in each of the publications.

The natural vegetation of the United States, H. L. SHANTZ and R. ZON (*U. S. Dept. Agr., Atlas Amer. Agr., pt. 1, Sect. E (1924), pp. 29, figs. 60*).—This publication treats of the natural vegetation of the United States, with special reference to the indicator significance of plant association to adaptability for agricultural crop or forest production.

Inventory of seeds and plants imported by the Office of Foreign Seed and Plant Introduction during the period from October 1 to December 31, 1922 (*U. S. Dept. Agr., Bur. Plant Indus. Inventory No. 73 (1924), pp. III+45, pls. 4*).—A list is given, together with economic notes, of more than 300 lots of seeds and plants introduced from various countries for testing in the United States. The list contains a large number of plants and seeds secured by J. F. Rock in Yunnan, China.

GENETICS

Any hereditary character and the kinds of things we need to know about it, O. RIDDLE (*Amer. Nat.*, 58 (1924), No. 658, pp. 410-425).—This is a discussion of the necessity for a broader consideration of hereditary factors. The major workers in genetics have dealt with the foundation and localization of hereditary factors in gametes and zygotes, or have dealt with the mechanism of distributing hereditary factors in gametes and zygotes, while the author emphasizes the importance of knowing more of the detail about any character, such as its origin, complete ontogeny, intimate nature, and control or transformability in ontogeny and phylogeny. Sex is suggested as a particularly favorable character for work of this kind, as a study of the metabolic

rate has been found to yield some progress in the direction of information of an intimate nature.

A hypothesis of "valence" in heredity and evolution, F. M. GETZENDANER (*Amer. Nat.*, 58 (1924), No. 658, pp. 426-435).—This is a theoretical discussion of the occurrence of attraction between certain genes.

Correlation among quantitative characters in maize, J. H. KEMPTON (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1095-1102, pl. 1, figs. 5).—The correlation among certain quantitative characters of corn was studied in the F_1 and F_2 of a cross between Tom Thumb pop corn, probably the smallest type of normal corn, and Jala, a giant variety from the west coast of Mexico. Consideration of the correlations led to the belief that while a great many heritable factors appear to be involved in the several differences between large and small varieties of corn, the correlations among the characters of size often are low or negligible, and there seems to be no genetic obstacle for forming recombinations of desirable quantitative characters by hybridization.

Segregation and correlated inheritance in crosses between Kota and Hard Federation wheats for rust and drought resistance, J. A. CLARK (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 1, pp. 1-47, pls. 3, figs. 9).—A genetic study was made in reciprocal crosses between Kota, a rust-resistant hard red spring wheat (E. S. R., 50, p. 33) and Hard Federation, a drought-resistant white wheat (E. S. R., 44, p. 39) in an attempt to obtain resistance to drought and rust in a high yielding hard red spring wheat of superior milling and bread-making quality. The material was grown at Davis, Calif., under ideal conditions, St. Paul, Minn., under conditions of rust prevalence, and at Mandan, N. Dak., under droughty conditions.

No important maternal or paternal influence was found, although a slight and consistent influence was noted for certain characters. The inheritance of awns was partially explained on a dihybrid Mendelian ratio. Although glume color did not appear to be inherited in a monohybrid ratio in F_2 , only one genetic factor proved to be involved. The color of the kernel segregated in F_2 in numbers close to the 15:1 ratio with two factors apparently concerned.

Early maturity as determined by date of heading was found to be dominant to late maturity. Tallness of plant appeared to be partially dominant but due principally to heterosis, and was easily affected by environmental conditions. Resistance to stem rust proved recessive and in F_2 seemed to approximate a 1:15 ratio. In F_3 , however, none of nearly 300 resistant F_2 families bred true for resistance. There was evidence that strains homozygous for resistance could be obtained in F_4 . Yield appeared to be due to multiple factors. Viscosity and crude protein determinations showed that segregation for quality and quantity of the gluten occurred prior to the F_4 . Evidence of segregation for the color and ash of the flour also was indicated among F_4 selections.

The amount of correlation between date of heading and plant height rose with increasingly unfavorable environmental conditions due to rust and drought. Date of heading and percentage of stem rust infection were correlated significantly and positively, the earlier plants apparently partially escaping rust. Date of heading and plant yield were negatively correlated, early plants proving more productive. Important and significant positive correlations were obtained between yield and plant height and between plant heights in 1922 and in 1923. Small positive correlations were found between awn and yield. Minor negative correlations were obtained between plant yield and stem rust infection. An important correlation existing between stem rust infections in 1922 and in 1923 seemed to prove that resistance is inherited.

Early, tall, awned, rust-resistant, high yielding plants predominate among selections made from the cross on the basis of the investigational findings.

Statistical studies of inheritance in the tomato, C. E. MYERS (*Pennsylvania Sta. Bul.* 189 (1924), pp. 3-31, figs. 14).—A presentation of data obtained in a statistical comparison between parental forms and certain segregates of a cross between the large fruited tomato, Enormous, and the Yellow Pear, varieties chosen because of their pronounced contrasting characters. The subjection of data recorded in the field to careful biometrical analysis showed that strains appearing entirely similar to the eye may be really quite distinct, leading to the suggestion that casual observations may lead to inaccuracies in interpreting the results of biological experiments. In comparing F_2 segregates, selected because of their close resemblance to the Enormous parent, with pure strains of Enormous, significant variations were noted. For example, in respect to the mean number of fruits per plant for the entire season, pure line Enormous strains *a* and *b* bore 10.523 ± 0.261 and 11.795 ± 0.315 , respectively, while the segregate bore 35.969 ± 0.544 . Mean average and mean total weights were also significantly different. Analysis of data taken in 1917, 1918, and 1919 upon the pure lines and the succeeding generations of selected segregates showed similar significant differences, bearing out the author's recommendation that biological material be submitted to accurate mathematical study. It is pointed out that one obstacle to accuracy in field comparisons of tomatoes is the fact that the fruit may be in various stages of maturity at the time of any one observation.

Studies in Indian tobaccos, Nos. 4, 5 (*India Dept. Agr. Mem., Bot. Ser.*, 13 (1924), No. 1, pp. 37, pls. 15, fig. 1).—Previous papers in this series have been noted (*E. S. R.*, 23, p. 338; 30, p. 29).

No. 4. *Parthenocarpy and parthenogenesis in two varieties of Nicotiana tabacum L.—var. Cuba and var. Mirodato*, G. L. C. Howard and K. Ram (pp. 1-16).—Under conditions at Pusa, parthenogenesis could be demonstrated neither in a Cuban variety of tobacco nor in a variety termed "Mirodato." Parthenocarpy was found to occur in the Cuban variety but not in Mirodato. A certain amount of parthenocarpy observed in hybrids between the two varieties was always associated with a white corolla similar to that of the Cuban parent, but the converse did not hold. All evidence obtained seemed contrary to Goodspeed's suggestion (*E. S. R.*, 34, p. 136) that parthenogenesis might develop with acclimatization.

No. 5. *The inheritance of characters in Nicotiana rustica L.*, G. L. C. Howard (pp. 17-37).—Neither parthenogenesis nor parthenocarpy was observed in the 20 Indian types of *N. rustica*.

Studies of hybrids between 6 of the types showed that in the F_1 the value of all characters except height is intermediate between those of the parents. The average plant height in F_1 surpassed that of the tallest parent. A frilled leaf margin was dominant to a smooth edge and seemed to be due to the presence of a single factor. The relative position of the anthers and stigma, and consequently the method of pollination, appeared to be influenced by factors affecting the length of the pistil and of the filaments. The difference between the tall and the short types of *N. rustica* seemed due to a single factor which causes elongation of the internodes of both the stem and the inflorescence. Other factors probably affect the height of the types of the two groups. The number of internodes is not deemed significant in the division between tall and short types. The form of the inflorescence appeared due to factors affecting the length of the internodes of the main axis of the inflorescence and also the proximity of the capsules on the branches. These factors influence the inflorescence only.

Litter production and the sex ratio in various strains of rats, H. D. KING (*Anat. Rec.*, 27 (1924), No. 5, pp. 337-366, figs. 2).—The number of litters and size of litters and sex ratios occurring in successive litters produced by females of the following strains of rats living to the approximate end of reproductive life at the Wistar Institute are tabulated: 148 stock albinos, 88 Norways reared in captivity, 51 piebalds (a black hooded variety), and 57 extracted albinos and 50 extracted Norways, both from F_2 crosses of Norway males \times stock albino females.

The number of litters and the duration of the reproductive life of individuals have been found to vary considerably. Except for the Norways, however, which are later maturing, females begin breeding when from 3 to 5 months of age, with the reproductive activity extending over a period of from 12 to 15 months. Environmental conditions and disease may also have a marked influence on fertility. The average numbers of litters produced per female in the different strains were as follows: Stock albinos 5.5, Norways 3.5, extracted albinos 4.7, extracted Norways 5.2, and piebalds 8.1. None of the Norway females had more than 7 litters, while one of the piebalds had 14 and two each of the extracted Norways and stock albinos had 13. None of the piebald females had less than 4, while four of the Norway females had 1 litter each and one of the extracted albino and six of the stock albino females had 2 each, indicating the great range in variability of the latter stock.

The number of young per litter was relatively small in all stocks for the first litters, while the second litters tend to be largest with gradual decreases in the size of subsequent litters, the variations being from a minimum of 1 or 2 to a maximum of from 12 to 16 in the different stocks. The average litter sizes were stock albinos 6.1, Norways 6, extracted albinos 5.9, extracted Norways 6.7, and piebalds 6.8.

The sex ratios of successive litters showed some variations among the strains, probably mainly due to small numbers, but the same general trend seemed to be evident, leading to the conclusion "that in these strains of rats the sex ratio shows a definite trend with the advance in the litter series: It is below the norm in early litters cast, rises slowly to a maximum, and drops abruptly to a very low point in litters cast at the end of the series." The Norways show a significantly lower sex ratio than the other strains, averaging 85.8 males per 100 females.

On Mendelian factors in radishes, J. C. T. UPHOR (*Genetics*, 9 (1924), No. 3, pp. 292-304, figs. 3).—Inheritance studies with the radish indicated that this species affords very satisfactory material for genetical investigations. In all crosses the form of the root and the length of the foliage were determined by a single factor pair, and the heterozygote was intermediate between the two parents. In crosses between red and white rooted varieties, the heterozygotes in every case were violet to purple, rendering detection easy. Finding that the factor for red striping gave a 1:1 ratio following self-fertilization, the author suggests the possible presence of a lethal factor. The yellow color of the Round Yellow variety was dominant over white. Crosses involving Black Winter with summer radishes showed the corky tissue around the periphery of the Black Winter dominant over its absence, and the black color dominant or almost completely epistatic over the other colors.

Studies in Indian fibre plants.—No. 3, On the inheritance of characters in Hibiscus sabdariffa L., A. and G. L. C. HOWARD (*India Dept. Agr. Mem., Bot. Ser.*, 13 (1924), No. 3, pp. 47-85, pls. 6).—Hybrids between four varieties of roselle (*H. sabdariffa*) (E. S. R., 27, p. 431) were employed in an investi-

gation of the factors governing the inheritance of the presence of red or crimson color; the red patches on the veins, petioles, and stems; the general color of the stem; and the color of the corolla and of the calyx. A list of 18 factors for color in roselle suggested by these studies is included.

Gamete production in certain crosses with "rogues" in peas, W. BROTHERTON, JR. (*Jour. Agr. Research [U. S.], 28 (1924), No. 12, pp. 1247-1252*).—Following an earlier paper (*E. S. R., 49, p. 741*), in which was advanced the hypothesis that rogue types of peas arise from normal types by the mutation of a single factor governing the mean ratio between length and width of stipules, the author now discusses the segregation occurring in the F_2 generation of reciprocal crosses between the Rice 330 (an early ripening nonrogue producing variety) and Gradus rogue, as well as back crosses between hybrids (rogue \times Rice 330) and normal type plants. The F_1 hybrids of Rice 330 crossed with Gradus rogue and the reciprocal were intermediate in appearance between the two parents, and had a mean stipule ratio of 2.185 ± 0.0213 as compared with 1.693 ± 0.0107 for true Gradus, 2.339 ± 0.0096 for Gradus rogue, and 1.991 ± 0.0086 for Rice 330. An analysis of 262 F_2 plants showed 217 rogues, 37 intermediates, and 8 broad stipuled plants, which is nonconformable to any Mendelian ratio. The progeny of the back crosses were for the most part either broad stipuled plants or distinct rogues. The roguelike segregates, although closely resembling pure rogues in their great variability, contained several chimeralike individuals characterized at the middle and upper nodes by having the corresponding stipules of each pair dissimilar, that is, one stipule narrow and pointed and the other broad and obtuse. Further genetical analysis is deemed necessary to determine whether the chimeras are merely heterozygous forms or are mosaics.

The absence of both kidneys associated with hereditary abnormalities in mice, H. J. BAGG (*Soc. Expt. Biol. and Med. Proc., 21 (1924), No. 5, pp. 228, 229*).—In continuing the study of the inheritance of the absence of the kidney in mice (*E. S. R., 51, p. 229*), it was found that the size of litters was low and the death rate soon after birth was high in litters born to parents each having one kidney. In a litter of seven born to parents, of which the sire had one kidney and the dam was heterozygous, three of the young were found to lack kidneys entirely while another showed only a trace of kidney tissue on one side. An association of the lack of kidneys with blindness was also suggested.

The problem of incidence in color blindness, C. H. DANFORTH (*Amer. Nat., 58 (1924), No. 658, pp. 447-456*).—Several theories are advanced to account for the preponderance of the numbers of color-blind females over the numbers of males, according to the expected relations based on a single recessive sex linked hypothesis. If the latter hypothesis is correct the deviations from expectation may be due to inbreeding, and thus may indirectly serve, as well as other sex-linked characters, as an index of the amount of inbreeding in a human population.

Effect of menotoxin on the viability of spermatozoa, D. I. MACHT and C. F. ELVERS (*Soc. Expt. Biol. and Med. Proc., 21 (1924), No. 5, pp. 254, 255*).—In studying the effect of menotoxin on the viability of spermatozoa at Johns Hopkins University, it was found in hanging drop preparations that menstrual serum was no more toxic than normal serum to human spermatozoa. Similar results have been obtained with serum solutions of oxysterol and cholic acid, indicating the similarity in the action between menotoxin and these substances.

Observations on the motility of the opossum genital tract and the vaginal plug, C. G. HARTMAN (*Anat. Rec., 27 (1924), No. 5, pp. 293-303, figs.*

5).—In studies at the University of Texas, the uterus of the opossum has been found to undergo cyclic changes in motility which are associated with oestrus. This is especially true of the lateral vaginal canals during oestrus and the time just preceding and following it. The canals are distended with fluid which is rapidly mixed with the semen at copulation, and probably some of the spermatozoa are very quickly brought up to the os uteri by the movement, since the fluid mixed with the semen in the canals soon coagulates to form the vaginal plug, thus preventing the escape of any spermatozoa entangled in it.

The effect of corpus luteum on behavior of rats, D. I. MACHT and D. W. SEAGO (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 5, p. 255).—Injections in female rats of doses of 0.2 to 0.5 cc. of "lutein," a protein-free extract of the corpora lutea of the sow, have been found to stimulate distinctly muscular activity and cerebrospinal efficiency as determined in experiments in a circular maze at Johns Hopkins University.

The back color of Russian rabbits and its meaning in our conception of acromegaly [trans. title], F. LENZ (*Arch. Rassen u. Gesell. Biol.*, 15 (1923), No. 1, pp. 24–33, pl. 1).—In experiments at the University of Munich the color of the hair on the back of Russian rabbits (white body with black ears, nose, feet, and tail) has been changed from white to gray or black by removing the hair from a certain spot and keeping the rabbit in a colder temperature while the new hair is growing out. When the hair was removed in summer the new growth was white. The black extremities of this type of rabbit are thought to be due to a lower temperature of these parts. The varying rates at which chemical reactions go on at different temperatures and the control of the uniformity of the temperature of various parts of the body through the hormones are discussed. It is suggested that a faulty mechanism for controlling the temperature in Russian rabbits is accountable for the dark color in the extremities and on the back when the hair was removed under exposure to cold.

The influence of environment on sex in hemp, *Cannabis sativa* L., H. C. MCPHEE (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1067–1080, pl. 1, figs. 3).—A study of the effect of relative length of day and night upon vegetative and floral development in *C. sativa* is reported, with a brief discussion of sexual dimorphism in hemp.

The ultimate height attained by hemp appeared to be due largely to the duration of rapid growth, which seems roughly proportional to the length of daily exposure to light. The time of flowering of hemp is largely controlled by the relative length of day and night, a daily exposure to light of seven hours seeming to produce the greatest acceleration of the flowering process. Three hours of light daily is the least in which hemp will grow for any length of time and attain the flowering stage. The daily period of illumination could not be curtailed sufficiently to prevent flowering, without causing the death of the plants. Sexual reversal did not necessarily follow when hemp was grown in the greenhouse during winter.

Removal of flowers did not necessarily result in sexual modification in hemp, although a few plants so treated and grown in a short daily exposure to light so reversed their sex that some apparently pure staminate individuals matured seed. Removal of flowers or even of the whole top from hemp grown in the field did not appear to result in significant sexual changes.

Although development and expression of sex in hemp are affected by environmental factors, the changes produced are often relatively minor, and the author holds that a sweeping conclusion that genetic factors are in no way concerned with sex in this species is not warranted at the present time.

FIELD CROPS

Research fundamental to the solving of crop-plant problems, C. R. BALL (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 9, pp. 553-632).—The symposium on research fundamental to the solving of crop plant problems, held at the meeting of the American Society of Agronomy in Cincinnati in December, 1923, included most of the following papers embraced in these pages: Taxonomy, by C. R. Ball; Taxonomy and Mycology, by C. L. Shear; Morphology, by R. A. Oakley; Plant Physiology, by W. Crocker; Cytology, by R. A. Harper; Biochemistry, by R. A. Gortner; Genetics, by H. H. Love; and Edaphics (Soils Research), by J. G. Lipman.

Experiments in crop rotation and fertilization, R. G. WIGGANS (*New York Cornell Sta. Bul.* 434 (1924), pp. 56, figs. 5).—A series of cropping systems including oats, wheat, potatoes, grass, and clover in different combinations was carried on from 1914 to 1921, inclusive, unfertilized, receiving a complete fertilizer, and with both complete fertilizer and manure. The yield data were subjected to statistical treatment.

All crops except timothy gave better yields when grown in rotation than in continuous culture. The best rotations used in this experiment included red clover, which excelled timothy in a rotation under these conditions. The results demonstrated that a cultivated crop should be included in all rotations on land suited to cultivation, that a 3-year rotation is too short under most conditions, that oats should probably never follow grass, and that grass in a rotation should be accompanied by a legume and for best production should remain down longer than one year.

Fertilizer and manure increased production regardless of the crop used to measure the effect, although rather heavy applications of fertilizer or manure to all the crops are probably unwise. Good rotations without manure maintained the production of oats and wheat practically as effectively as heavy applications of complete fertilizer on continuous crops, while the best unmanured rotation about equaled a heavy application of fertilizer combined with a medium application of manure on crops grown continuously.

Studies in crop variation.—III, An examination of the yield of dressed grain from Hoos field, W. A. MACKENZIE (*Jour. Agr. Sci. [England]*, 14 (1924), No. 3, pp. 434-460, figs. 7).—A statistical analysis of the yield of dressed grain from Hoos barley field of Rothamsted Experimental Station, similar to that of Fisher with wheat on Broadbalk field (*E. S. R.*, 46, p. 137), was made to determine the slow changes which have taken place in the mean yields of 13 plats, each receiving a particular fertilizer treatment continuously from 1852-1921, inclusive, and to indicate the relationships between fertilizer treatment and mean yield and deterioration, respectively. The previous paper of this series (*E. S. R.*, 50, p. 234) dealt with the manurial response of potato varieties.

Of the three nitrogen sources, rape cake showed the highest mean yields in the absence of superphosphate, while sodium nitrate showed notably better results than ammonium salts. Superphosphate is evidently of importance to the barley crop, its application giving greatly increased yield, whereas potassium sulfate seems to have an adverse influence.

The deterioration of the barley plats is much heavier than the wheat plats. The author considers that the convention of ascribing the whole linear term to deterioration may not be as true for some plats as for others, since part of the diminution in mean yield may be due to slow changes other than deterioration. The mean annual percentage diminution, which is least on the plats receiving

superphosphate, emphasizes the importance of phosphoric acid not only in increasing the mean yield, but in maintaining the fertility of the soil. Barley seems to be more variable than wheat and more subject to the influence of meteorological conditions. The slow changes other than deterioration are relatively unimportant and seem closely connected with the fertilizer treatment.

Experiments with fallow in north-central Montana, G. W. MORGAN (*U. S. Dept. Agr. Bul. 1310 (1925), pp. 16, figs. 6*).—Experiments in cereal production with summer fallow and other methods of cultivation have been in progress since 1917 at the Assiniboine Field Station, near Havre, Mont., in cooperation with the Montana Experiment Station. This bulletin summarizes the results for the period 1917–1923.

The yields of small grain averaged higher on fallow than on disked corn ground or with continuous cropping to small grain. Yields from disked corn land were about midway between those from continuous small grain and those from fallow. Yields on corn ground exceeded those on fallow in 1919, which was the year of lowest yields. Yields of wheat in 1922 and of oats in 1918 on continuous cropping were slightly higher than on disked corn ground.

The total yields of corn (stover and grain) from fallow were about 1,000 lbs. more than with any of the three best methods of continuous corn growing, but corn grown continuously on spring plowing, fall plowing, or subsoiling was produced cheaper than that grown on fallow.

The yields of oats and winter wheat after green manure crops were about half those after fallow, and yields immediately after green manures were much less profitable than those from fallow. The average yields after field peas as green manure slightly exceeded those after either winter rye or sweet clover as green manures. Barnyard manure applied before plowing for fallow did not increase the yield of either winter wheat or oats.

Winter wheat has yielded about the same from fallow plowed in the fall and left rough the first winter as from that plowed in May. Fall-plowed fallow cultivated immediately gave lighter yields than fall-plowed fallow left rough the first winter. Fallow plowed in July made consistently lighter yields than that plowed in May. Plowing 8 in. deep for fallow was more profitable with oats, barley, and winter wheat than plowing 4 in. deep or plowing 8 in. and subsoiling to 18 in. Subsoiling produced more oats than 8-in. plowing, but the increase did not pay for the additional cost.

For spring wheat the fallow period from harvest until the following seeding date was between 20 and 21 months, during which time the total precipitation varied from 11.6 to 20.46 in., the water stored in the surface 3 ft. of soil varied from 1.77 to 4.25 in., and the percentage of the precipitation stored in the soil varied from 10.1 to 22.8. The precipitation for the 7 years covered by this report was below normal.

Work of the Sheridan Field Station for the seven years from 1917 to 1923, inclusive, R. S. TOWLE (*U. S. Dept. Agr. Bul. 1306 (1925), pp. 31*).—Experiments with crop rotations and tillage methods, variety and planting tests of cereals, forage crops and potatoes, and shelter belt investigations were conducted cooperatively at the Sheridan, Wyo., Field Station during the period 1917–1923. Climatic records and the seasonal variations in yield show the seasonal rainfall to be the chief controlling factor in crop production over the area immediately east of the Big Horn Mountains.

While in some years crops on fall plowing differed materially in yield from those on spring plowing, the average differences over a period of years are not held significant if spring plowing does not unduly delay seeding. Yields of small grain on corn ground slightly exceeded those on land that was in small

grain the previous year. Spring grain on corn land averaged only slightly less than on fallow. Growing grain crops on disked corn ground, one of the cheapest methods, gave yields practically as large as those on plowed corn ground.

Winter wheat may be expected to give fair yields on fallow even in dry years. Spring grains are more certain on fallow than after small grain or corn, but the increases are not as large as with winter wheat. Fallow plowed about the time of plowing for corn outyielded that plowed either later or in the previous fall. Barnyard manure did not increase yields noticeably in rotations begun on new land. Green manure increased the cost but not the yield, making its use unjustifiable.

Kharkof was the highest yielding winter wheat, and Trebi led the barleys tested. No spring wheat outyielded Marquis enough to warrant replacing that variety. Early oats of the Sixty-Day type yielded best in dry years, while later or midseason varieties were best in other years. The early varieties of dent corn, Northwestern and Payne White, matured ripe corn nearly every year. Early flint varieties have produced well and are considered valuable for hogging off. Seeding late in September or early in October about 1 bu. per acre gave the best results with winter wheat, while seeding in April at the same rate or slightly less per acre produced the best yields of spring wheat, oats, and barley.

Sorgo was the highest yielding forage crop. Red Amber sorgo and Kursk millet led their varieties. Wheat following sorgo yielded less than after corn or small grains, whereas this effect was not apparent with oats. Seeding alfalfa and Sudan grass with the grain drill produced an average nearly as high as obtained by seeding in rows. Varieties of field peas did not yield satisfactorily, nor was sweet clover an unqualified success. Yellow sweet clover surpassed the white species in yield and quality of hay in the years grown.

[Field crops work at the Alaska Stations], C. C. GEORGESON (*Alaska Stas. Rpt. 1923, pp. 4-13, 14-16, figs. 7*).—Experimental work reported on in continuation of earlier investigations (E. S. R., 50, p. 532) included plat and field trials of varieties and hybrids of wheat, barley, oats, and alfalfa; field tests with rye, annual and perennial vetch, *Trifolium lupinaster*, and field peas; rotation experiments with legumes; trials of Jerusalem artichokes, sunflowers, and soy beans for silage; and tests of potato varieties and seedlings.

[Field crops work in South Carolina] (*South Carolina Sta. Rpt. 1924, pp. 28-31, 35-39, 56, 57, 74-79, 83, 84, 85, figs. 11*).—Field crops experiments reported on in continuation of earlier work (E. S. R., 50, p. 637) included variety tests with corn, wheat, oats, barley, rye, soy beans, sweet potatoes, and peanuts, and soy beans and cowpeas for hay; source of seed tests with potatoes; fertilizer trials with corn, oats, peanuts, and potatoes, and on pasture; breeding work with corn, velvet beans, and peanuts; curing tests with tobacco; and trials of pasture grasses and miscellaneous legumes.

[Field crops work in Tennessee, 1923], C. A. MOOERS and S. H. ESSARY (*Tennessee Sta. Rpt. 1923, pp. 19-21, 22*).—Experiments with field crops are reported on, continuing earlier work (E. S. R., 51, p. 337). Varietal and place effect trials with cotton and spacing tests with corn and breeding work with both crops are commented on briefly.

Korean lespedeza (E. S. R., 51, p. 743) was the earliest of the lespedezas tested and continued to be of promise for the higher and shorter seasoned parts of the State. Lespedeza selection No. 76 excelled the common variety in west Tennessee, and produced heavy seed yields in both ends of the State. American strains of red clover were very much more susceptible to clover mildew

than strains from Europe and South America but suffered much less from anthracnose. The foreign strains yielded slightly more hay from the first cutting than the American strains, but they were soon almost completely killed by anthracnose, whereas the American strains made an abundant late crop and survived the winter in good shape.

[Field crops experiments in Northumberland County, England], D. A. GILCHRIST (*Northumb. Co. Ed. Com. Bul. 36* (1924), pp. 9-56).—The continuation of experiments with field crops at the County Experiment Station at Cockle Park is described as heretofore (*E. S. R.*, 50, p. 134).

[Field crops experiments in Mysore], H. V. KRISHNAYYA ET AL. (*Mysore Dept. Agr. Rpt. 1922-23, pts. 1, pp. 5, 6; 2, pp. 5-7, 21-33, 35-37, 40-44, 52, 53, 69-73, 75-78*).—The progress of work along the same general lines noted earlier (*E. S. R.*, 50, p. 433) is reviewed. Studies of the fertilization of the ragi and peanut flowers and hybridization work with peanuts are described by V. K. Badami. Cold-pressed castor oil was found to be the best medium for germinating cotton pollen.

Spring small grains, T. A. KIESSELBACH and W. E. LYNES (*Nebraska Sta. Bul. 201* (1924), pp. 45, figs. 13).—The results of variety trials, seed selection tests, and cultural treatments carried on during extended periods with oats, wheat, and barley are summarized, and the grain yields of different small grain crops are compared.

Early maturing varieties are recommended for the State, although medium early sorts do relatively well in northern Nebraska. Nebraska No. 21 and Burt early oats, Marquis and Java common spring wheats, and common six-row, Oderbrucker, and Manchurian barleys are the best varieties commercially available for the State. Prelude, a newly introduced early wheat, may have special value for seeding in partly winterkilled wheat fields. Durum wheats should be confined to parts of western Nebraska. Awned barleys led by Club Mariout yielded much higher than the awnless varieties. Source of seed was not shown to be a vital factor in the yield of self-fertilized small grain crops provided the correct variety or strain is used.

The order of resistance to spring frost, spring wheat, oats, barley, is considered the best sequence of planting. Seeding between March 15 and April 1 is recommended for the eastern half of the State. Since spring sometimes begins somewhat later farther west, seeding may be proportionately delayed. Rates of planting per acre recommended for eastern Nebraska are 8 to 10 pk. for oats, 6 pk. for spring wheat, and 8 to 10 pk. for barley. In central and western Nebraska best results accrue from acre rates of 6 pk. of oats, 4 pk. of spring wheat, and 6 to 8 pk. of barley. The reduction in rate of seeding should be gradual from eastern toward western Nebraska. Broadcasted and drilled oats differed little at the station, while at North Platte (*E. S. R.*, 49, p. 527) broadcasting yielded 30 per cent less than drilling for barley, 24 per cent less for spring wheat, and 20 per cent less for oats.

Planting mixtures of varieties or pure strains of oats proved less desirable than growing the best ones separately. As an average for 18 years the heavy seeds of Kherson oats surpassed the light seed 0.9 bu. per acre, and yielded 0.5 bu. more than the original unselected oats with little difference in the quality of the crop harvested. Ordinary Kherson oats, a natural mixture of many strains, were no more affected by grading than was a single pure line strain. Hand-selected small Kherson oats averaged 6.2 per cent less than hand-selected large seed when compared in equal numbers. Planted in equal weights, the original unselected and the small seed yielded 0.7 and 1.2 per cent, respectively, less than the large. When large and small seeds of Kherson oats.

Nebraska No. 21 oats, and Java spring wheat were spaced to permit maximum individual plant development, the small seed consistently produced slightly shorter and later ripening plants with fewer heads and with grain yields, respectively, 83, 75, and 82 per cent as much per plant as large seed of the same varieties. Harvesting oats slightly green, not to exceed 2 days before maturity, seemed to be a satisfactory practice. At rates normal for large seed, large, unselected, and small seed of spring wheat planted in equal numbers per acre yielded 13.3, 12.7, and 11.3 bu., and planted in equal weights yielded 13.3, 13.4, and 12 bu. per acre, respectively.

Notes on some recently imported forage grasses [trans. title], R. FERNÁNDEZ GARCÍA (*Porto Rico Dept. Agr. and Labor Sta. Circ. 81 (1924)*, *Spanish ed.*, pp. 19, figs. 5).—Comment is made on the behavior and yields of elephant grass, Guatemala grass, molasses grass, kikuyu grass, Dallis grass, Natal grass, and Johnson grass, with tables showing proximate analyses of these grasses and the quantities of digestible nutrients in 100 lbs. of green material.

The effect of different forms of nitrogenous fertilizers on the relative and absolute protein contents of alfalfa [trans. title], W. BEHLEN (*Ztschr. Pflanzenernähr. u. Düngung*, 3 (1924), No. 8, *Wirtschaft.-Prakt.*, pp. 326-340).—Applications of nitrogenous fertilizers in different forms and amounts to alfalfa gave results showing that, regardless of the form, nitrogenous fertilization did not affect the relative and absolute protein content of the alfalfa. The use of nitrogenous fertilizers on alfalfa is not advised because of the very slight probability that the cost will be covered by increased yield.

Report on the analyses of the barleys of 1922 and the malts made from them, H. L. HIND (*Jour. Inst. Brewing*, 30 (1924), No. 11, pp. 969-986, figs. 9).—Analyses of the barleys described by Russell (*E. S. R.*, 50, p. 233), of the malts made from them (*E. S. R.*, 51, p. 36), of several varieties grown under different fertilizer treatments at Rothamsted, and of some barleys raised by the National Institute of Agricultural Botany and their malts, are tabulated, in most cases without comment.

Second report on the experiments on the influence of soil, season, and manuring on the quality and growth of barley, 1923, E. J. RUSSELL (*Jour. Inst. Brewing*, 30 (1924), No. 9, pp. 818-837).—The yields and quality of barley in these experiments were generally much higher in 1923 than in the previous year (*E. S. R.*, 50, p. 233). The complete fertilizer increased the yields in all but two cases. Nitrogen was most effective and was followed by phosphate, while potassium fertilizers produced measurable effects only on the light soils.

The effects of fertilizer on the valuation were not very consistent, and the relation between the valuation and nitrogen content of the grain, when comparing barley from the different centers, was less marked than in 1922. The nitrogen content of the grain was usually depressed by phosphate and increased by nitrogen, while potash had but little influence. The moisture content of the grain was usually lower on the plats receiving nitrogen and phosphates than on plats not so treated, and about the same on plats receiving or omitting potash. Within limits of variation of about 17 per cent, changes in moisture content appeared to have less effect on valuation than changes in nitrogen content.

Second report on the influence of soil, season, and manuring on the quality and growth of barley, as indicated by the malts made therefrom, H. M. LANCASTER (*Jour. Inst. Brewing*, 31 (1925), No. 3, pp. 104-114).—Malting tests with the barleys discussed above tended to confirm the results of the previous year (*E. S. R.*, 51, p. 36). Other things being equal, differences in

fertilizer treatment resulted in practically no difference in the market value of the barleys, as judged by their malts. Soil and season seemed to be predominant in determining both actual and market value.

The effects of fertilizers on the yield and the ear characters of corn, T. K. WOLFE (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 8, pp. 551, 552).—The effects of certain fertilizers on the yield and ear characters of corn were studied in a rotation on Hagerstown silt loam at the Virginia Experiment Station.

As compared with the check, the fertilizers used increased the yield of corn very materially and, with one exception, made the ear characters more pronounced. In most instances the complete fertilizer gave nearly as good as or better results than the stable manure. In its effect on ear characters and yield the complete fertilizer surpassed acid phosphate, nitrogen and potassium in combination, and the check in the order named.

Handling the soft-corn crop, F. D. RICHEY (*U. S. Dept. Agr., Dept. Circ.* 333 (1924), pp. 8, pls. 2, figs. 4).—The different ways by which soft corn can be used or preserved, as outlined in this circular, are based largely on experimental results at the Illinois, Iowa, Minnesota, and Nebraska Experiment Stations and the published experiences of farmers. The information is particularly applicable to conditions in the northern part of the Corn Belt and northward.

Spacing experiments with Acala cotton in southern California, H. G. MCKEEVER (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1081-1093, figs. 3).—Experiments with cotton under irrigation in the Coachella Valley of California, wherein plants were spaced about 2, 6, and 12 in. apart in the row, gave indications that reduced yields do not follow when plants are left as close as 2 in., and that increased yields sometimes may be obtained from plants spaced 2 in. apart, even under long-season, weevil-free conditions. Plants spaced at 6 in. seemed to produce as well as or better than plants spaced 12 in. apart. However, since 6-in. spacing is not convenient in field operations, practical alternatives are suggested providing for 2 plants together at 12 in. or omitting the chopping operation, except in thick stands, when some plants should be pulled out. The yields in the first picking were about the same for all spacings, while in the second picking the 2- and 6-in. spacings outyielded the 12-in. in the order given. The early crowding of closely spaced cotton, which may result in suppressing some of the lower fruiting branches as well as of the vegetative branches, is lessened by the plants spreading apart as they become larger.

[Cotton investigations in South Carolina] (*South Carolina Sta. Rpt.* 1924, pp. 15-25, 27, 28, 34, 35, 73, figs. 5).—These pages report experiments continuing and supplementing previous work (E. S. R., 50, p. 638; 51, p. 234). Although closely-spaced cotton was little earlier than wide-spaced during a very wet season at Florence, the earliest and best yields came from spacing as close as 9 or 12 in. At Clemson the closely-spaced cotton continued to give the highest yield and the earliest crop. The results obtained indicate that the earliest crop and the highest yields are apt to be obtained from a spacing giving from 15,000 to 20,000 plants per acre, at which rate an average of 5 to 6 mature bolls per stalk will yield a bale of cotton per acre. Acid-delinted seed again excelled in the seed treatment tests. Plats chopped as soon as a stand was obtained gave the best yields.

Fertilizer trials with cotton substantiated results recorded earlier. Side applications of sodium nitrate seemed most profitable, especially just after the cotton is chopped.

At Florence, Lightning Express, College No. 1, and strains of Webber 49 began fruiting ahead of other varieties and these together with certain Cleveland strains, Deltatype Webber, and Carolina Foster, put on squares most rapidly during June and early July. Although Trice, Delfos, Lightning Express, Acala, King, and Carolina Foster started fruiting first at Clemson, the most rapid square formation during the first month of the fruiting period was observed on Cleveland strains, Lightning Express, Carolina Foster, College No. 1, and Acala. Little difference was seen in the periods required for a fruit bud (square) to develop to a bloom, about 23 days being needed for all varieties in 1923 and a few days longer in 1924. However, varieties differed in the length of time from bloom to open boll, in the rapidity of the growth of the bolls during the early stages of development, and in the rate of hardening of bolls. Correlation was apparent between the rate of hardening of the bolls and the seasonal conditions. The leading varieties at the station, at Florence, and at the Coast Substation are indicated with their acre yields.

Certain seasonal factors seem to influence the periods required for a fruit bud or square to reach the bloom stage and for a boll to develop from bloom to maturity. A very definite correlation has existed between the length of day and the boll period. Abortion of early buds and squares, evidently connected in some way with the unusually rainy season, is also commented on.

Stripping squares at any time or in any amount has not produced a net gain in yield. Early topping seems to delay maturity and reduce the yield slightly. Topping later in the season had little effect on yield but the topped cotton seemed to open up earlier and better than untopped plants. April plantings have given best stands and yields at Florence. Fruiting studies at Clemson showed that the rate of blooming and the total number of blooms varied directly with the time of planting.

Cotton variety experiments at the main station, 1912 to 1922, G. N. STROMAN (*Texas Sta. Bul. 321 (1924), pp. 3-20, fig. 1*).—Varietal experiments with cotton carried on at the college station from 1912 to 1922, inclusive, are summarized. The relative rank of the leading varieties during the period 1919-1922 was Belton, Truitt, Acala, Lone Star, Rowden, Durango, Kasch, Mebane, and Bennett. These are considered standard varieties for this section of the State. Averaging production during the years 1917-1922 showed the order to be Acala, Lone Star, Rowden, Durango, Mebane, and Kasch. Lone Star, Mebane, and Rowden ranked in order during the years 1912-1922, inclusive. High yields seemed to be correlated with well distributed rainfall, especially during June, July, and August, while the total annual rainfall was apparently without effect on yields. No significant correlation was found between lint percentage and yield of lint per acre.

The moisture relations of cotton, II, III, A. R. URQUHART and A. M. WILLIAMS (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem., 3 (1924), Nos. 17, pp. 197-206, figs. 4; 27, pp. 307-320, figs. 9*).—Further investigations. (*E. S. R., 51, p. 235*) on this subject are reported on.

II. The absorption and desorption of water by soda-boiled cotton at 25° C.—By a method considered more reliable than that given previously for the accurate determination of the moisture content at all humidities, soda-boiled cotton was found to absorb 22.6 per cent of water from a saturated atmosphere. The studies indicated that the hysteresis of cotton does not extend to zero humidity, but that the curves meet at $p/P=0.018$, and that no tendency is apparent for the loop to close at the saturation value. An explanation of the phenomenon of hysteresis is offered which depends on a theory of the capillary structure of cotton not inconsistent with botanical views. The diameter of the smallest pores in cotton was found to be of the order of 13×10^{-8} cm.

III. *The effect of temperature on the absorption of water by soda-boiled cotton.*—Experiments concerned with the absorption of water by cotton at all humidities and at temperatures up to 110° gave results showing that when the relative humidity is constant at less than 80 per cent, an increase of temperature from 10 to 110° reduces the moisture content of the cotton. When, however, the relative humidity is constant at more than 80 per cent, a similar decrease in moisture content only occurs as the temperature rises from 10 to 50°, while from 60 to 110° the moisture content may actually increase with rise of temperature. The increase of moisture content under constant high humidities, which begins at about 60°, is apparently due to swelling of the material and the consequent exposure of new surface. Processes depending for their success on the swollen state of the cotton will consequently be facilitated above 60° at high humidities.

The relation between the breaking strength of cotton yarns and the twist at the place of breaking, W. ENGLISH (*Jour. Textile Inst.*, 15 (1924), No. 8, pp. T385-T400, figs. 6).—Combed and carded Egyptian cotton yarns were spun to 60s on the ring frame with twist constants 2, 3, and 4, at the Manchester College of Technology. Within the range of twist investigated the mean strengths of the yarns increased with the twist, as did also the frequency of the breaks occurring at places of maximum twist in a specimen, but this was lower for carded qualities than for combed qualities of similar twist.

Kikuyu grass (Pennisetum clandestinum, Chiov.), O. STAPP (*Agr. Jour. India*, 19 (1924), No. 4, pp. 415-425, figs. 12).—The history, merits, habits, and characteristics of kikuyu grass are set forth with a detailed botanical description.

Field experiments [with oats], R. A. BERRY and D. G. O'BRIEN (*Jour. Agr. Sci. [England]*, 14 (1924), No. 3, pp. 407-412, fig. 1).—Examination of the yields in single plat tests with oats at the experiment station at Kilmarnock, of the West of Scotland College of Agriculture, showed that the size of the experimental errors renders single plat trials practically useless for comparing the grain yields of two oats varieties. The probable error on single plat trials amounts to about 18 per cent of the grain yield for the old Scotch varieties of oats and to about 20 per cent for the new varieties. Adopting single plat trials, an error of 18 per cent means that in a comparison of the grain yield of two varieties, when the difference is not likely to exceed about 5 per cent, 214 centers with no duplication of plats at any center would be needed to try for conclusive results from one year's trials, and 53 centers when the two varieties differ in yield by 10 per cent.

Growing orchard grass in south Missouri, C. A. HELM (*Missouri Sta. Circ.* 130 (1924), pp. 8, figs. 5).—Orchard grass is compared with timothy, its place in cropping systems is indicated, and practices are outlined for fall and spring seeding, harvesting for seed and hay, pasturing, and establishing orchard grass in permanent Ozark pastures.

Experiments with potatoes, I, II (*New York State Sta. Bul.* 518 (1924), pp. 3-36).—These experiments are reported on in two parts.

I. *Dusting vs. spraying*, F. C. Stewart and P. J. Parrott (pp. 3-29).—In comparisons during the years 1920-1923, inclusive, of the efficiency of the Sanders' copper-lime dust and of liquid Bordeaux mixture for the control of the insect and fungus enemies of potato foliage the spray gave much the better results, as shown by the appearance of the foliage and by the yield of marketable tubers. Both early blight and late blight were controlled fairly well by dusting but considerably better by spraying. The dust proved almost valueless for

the control of tipburn or hopperburn (caused by leafhoppers), whereas the spray showed high efficiency. Nevertheless, the dust may be advisable under certain conditions, as where water is difficult to obtain and in small fields where hand machines are required.

II. *Row competition and "border effect,"* F. C. Stewart (pp. 30-36).—Row competition and border effect were studied in the three-row plats used in the dusting and spraying experiments in 1922 and 1923. In the wet season of 1922 the outside rows definitely outyielded the middle rows, while in the dry season of 1923 only an insignificant difference was found in favor of the middle rows. Furthermore, in 1922 the south outside rows outyielded the north outside rows, apparently because of the better illumination of the former. Weather conditions are held to have an important relation to row competition and border effect in potato plats.

Sprays outrank dusts for potatoes (*New York State Sta. Bul. 518, pop. ed. (1925), pp. 4*).—A popular edition of the above.

Rice, E. B. COPELAND (*London: Macmillan & Co., Ltd., 1924, pp. XIV+352, pls. 20*).—Based largely on the experience and observations of the author and recent investigations, this volume, world-wide in its scope, deals with the botany of rice; climatic, soil, cultural, and water requirements; diseases and pests; seed and varieties; the industry in the United States, Philippines, and other countries; and the uses of rice. A discussion of the commercial, economic, and social aspects of the crop concludes the work.

Sugar beets in Louisiana, A. F. KIDDER and C. E. COATES (*Louisiana Stas. Bul. 192 (1924), pp. 23*).—Varietal and date of planting tests during four years suggest the possibility of growing sugar beets commercially in Louisiana. Sugar beets containing from 13 to 14 per cent sucrose with a purity of 80 to 85 per cent were grown successfully without fertilizer on bluff soils and on cut-over pine lands near Baton Rouge. The yields indicate that from 10 to 15 tons per acre can be produced. The harvest season has varied from 7 to 12 weeks in length, beginning about May 1.

The reference book of the sugar industry of the world (*La. Planter, Ref. Book Sugar Indus. World, July, 1924, pp. 144, pls. 4, figs. 37*).—Similar in its scope to the earlier work (E. S. R., 49, p. 737), this second annual review of the sugar industry includes the following articles of interest to the agronomist:

The Sugar Crop in Java in 1923, by H. C. P. Geerligs (p. 43); Sugar in Central Brazil, by J. B. Silvado (pp. 44, 45); Mauritius and Its Sugar Industry, by H. A. Tempany (pp. 45-48); The Natal Sugar Industry, by D. M. Eadie (pp. 48-50); Sugar Cane Agriculture and Manufacture in Jamaica, by F. M. K. Jarrett (pp. 50, 51); Good Tilth and Drainage Essential to a Successful Cane Crop in Louisiana, by W. C. Stubbs (p. 70); Four-Year Rotation Experiments at the Sugar Experiment Station, Baton Rouge, La., by W. R. Dodson (pp. 70, 71); Abandoned Virgin Soils in Cuba, by J. R. Zell (pp. 71-75); The Beet Sugar Industry of Wisconsin, by S. G. Ruegg (pp. 84-86); Irrigation and Growth of Sugar Beets, by F. C. Jean (pp. 86-88); and Sugar Beet Harvest Problems, by F. Saunders (pp. 88, 89).

Sweet potato studies in New Jersey, L. G. SCHERMERHORN (*New Jersey Stas. Bul. 398 (1924), pp. 19, figs. 12*).—Results in investigations concerned with sweet potato fertilizers and factors influencing the shape of the sweet potato have been recorded earlier (E. S. R., 51, p. 342). The effects of different percentages of potash on the ratio of length: diameter are illustrated, and the preliminary results of hill selection are summarized briefly.

Investigations with high-nicotine tobacco (*New York State Sta. Rpt. 1924, p. 21*).—*Nicotiana rustica* of the 1923 crop had a much higher nicotine content

than that of 1922. Adaptation was probably a factor. Broadcast tobacco of this species again had less nicotine than cultivated plants. The nicotine content of varieties of *N. tabacum* grown in 1922 was much lower than *N. rustica*, but varied only from 1.1 to 1.64 per cent. Other phases of this work have been noted (E. S. R., 52, p. 138).

Nicotiana rustica as a source of nicotine for insect control, D. E. HALEY, F. D. GARDNER, and R. T. WHITNEY (*Science*, 60 (1924), No. 1555, pp. 365-366).—Analyses at Pennsylvania State College of plants of *N. rustica*, the nicotine content of which had been increased by selection, disclosed that plants topped during growth contained 2.75 per cent of nicotine, suckered plants 3.79, plants topped and suckered 4.4, and untreated plants 1.61 per cent. Results from both Lancaster and Clinton Counties were very similar as to the nicotine contents of the leaves and stalks of the topped and suckered plants. In every case the percentage of nicotine in a topped or suckered plant greatly exceeded that of an untreated plant, the results agreeing more or less with those of Oosthuizen (E. S. R., 49, p. 36).

Methods of extracting nicotine from tobacco are outlined briefly.

Common vetch and its varieties, R. MCKEE and H. A. SCHOTH (*U. S. Dept. Agr. Bul.* 1289 (1925), pp. 20, figs. 8).—*Vicia sativa* and its varieties are described and classified; adaptation, varietal variation, and relative winter hardiness are commented on; and summary accounts are given of experiments with the crop in cooperation with the Oregon Experiment Station.

Under average conditions seed of common vetch will diminish little in vitality in from 6 to 8 years, tests showing no difference between varieties in this respect. The percentage of hard seed is not high except in *V. sativa macrocarpa*. At Corvallis, Oreg., the hard seed content of this variety has ranged for various seasons from 60 to 99 per cent 3 months after harvest and diminished about 15 per cent during each subsequent year. Other Oregon vetch seed germinates promptly, and under favorable conditions over 90 per cent germinates in the first 3 days.

While vetch flowers are highly self-fertile, tripping may be slightly effective in aiding fertilization. Inclosing the flowers in tarlatan cages and paper bags seems to decrease to some extent the number of flowers setting pods. Insects that may trip the flowers are not essential to seed setting, although perhaps somewhat beneficial. Numerous species have been found working on *V. sativa* plants.

Spring seedings have given very poor yields, whereas fall seedings are generally productive. Early fall seedings are suggested for best results. The best rates of seeding for western Oregon and western Washington seem to be 80 lbs. of vetch when sown alone, and 60 lbs. of vetch and 40 lbs. of oats when used in combination. The usual winter injury will probably necessitate as heavy rates for the South Atlantic and Gulf Coast States. For California 60 lbs. of common vetch when sown alone, and 50 lbs. of vetch and 30 lbs. of oats or other small grain are recommended. Limited experiments indicate that drilling somewhat excels broadcasting. Depths of seeding between 1 and 4 in. did not affect yields. While rotation has been beneficial to seed yields of vetch, oats being one of the best crops for this purpose, at the same time continuous cropping to vetch has not decreased the yield. A decrease occurred in the vetch hay yields when rotated with oats and an increase when rotated with corn.

New ways of determining the origin of seed [trans. title], G. TRYTTI (*Tidsskr. Norske Landbr.*, 31 (1924), No. 5, pp. 189-199, figs. 12).—Characteristic weed seed and the floral and mineral complex of the sample give indications of the source of seed. Fragments of horse nettle (*Solanum carolinense*)

with stellate hairs characterize *Poa* and *Agrostis*, and fragments with single hairs are found in *Phleum* and *Festuca* seed from the United States. Undetermined black excrements, such as are found in timothy, are said to be one of the characteristics of seed of American origin. Eolian sands may signify a central European source, while the samples from Norway, north Sweden, Finland, or Canada may contain the sharp alluvial or sea sand.

A viability test for some tropical seeds, A. TOLENTINO (*Philippine Agr.*, 13 (1924), No. 3, pp. 129-141).—Experiments at Los Baños, P. I., showed that potassium hydroxide, after the method of Lesage (*E. S. R.*, 25, p. 222), is a practical test reagent for the viability of the seeds of some tropical crops. The strength of solutions and time required to test viability for different crop seeds were as follows: Rice 0.2-0.3 N, 3 hours; corn 0.2 N, 3 hours; squash 0.4 N, 3 hours; brown mungo bean 0.025 N, 3 hours; and gray Lima bean 0.05 N, 0.5 hour. The test was not applicable to naturally colored seeds such as sitao (*Vigna sesquipedalis*), red mungo, McCall bean, red Lima bean, patola (*Luffa acutangula*), calamismis (*Psophocarpus tetragonolobus*), papaya, and sincamas (*Pachyrrhizus erosus*).

The embryo appeared to be chiefly responsible for the discoloration of the solution by dead seed, but never in the case of viable seed. Discoloration by the seed coat alone is insufficient to indicate dead seed. The most common color of the discolored potassium hydroxide solutions is either yellow or brown, and that of dead seeds is either amber or dark brown or a combination of both. Seeds with rigid, hard, and colorless seed coats require rather strong solutions. The number of seeds germinating after soaking in such solutions varied inversely with the strength of the solution when that strength exceeded the optimum, probably due to a lethal effect of the potassium hydroxide.

Nitrogen content of weeds, E. G. CAMPBELL (*Bot. Gaz.*, 78 (1924), No. 1, pp. 103-115, figs. 4).—Analysis of *Amaranthus retroflexus* and 25 other weed species collected at 3 stages of development and under various growth conditions showed that nitrate nitrogen (*E. S. R.*, 51, p. 39), prominent in plants of *A. retroflexus* and some other weeds during young and immature stages, completely disappears at full maturity, contrary to Woo's (*E. S. R.*, 43, p. 225) prediction. In all species grown under normal conditions, the highest percentage of nitrate is said to be found in the stage termed just before blooming. Nitrate was still present at early maturity, and at full maturity in *A. retroflexus* and *Atriplex patula* grown upon manure piles and heaps of decaying hog hair.

HORTICULTURE

[**Horticultural investigations at the Alaska Stations**], C. C. GEORGESON (*Alaska Stas. Rpt. 1923*, pp. 14, 15, 16, 17, figs. 3).—In accordance with earlier reports (*E. S. R.*, 50, p. 539), brief notes are presented upon the behavior of various vegetable and fruit plants. The Petrowski turnip and the Yellow Transparent apple continued to show marked superiority for Alaskan conditions. While certain sour cherries produced fruit in 1923, the sweet varieties were failures, as were also pears and plums. Small fruits, namely, currants, gooseberries, and raspberries yielded well, and the Sitka hybrid strawberries (*E. S. R.*, 50, p. 140) gave satisfaction wherever tested, even in the interior of Alaska, where commercial varieties from the United States invariably winterkill. A large number of apple, gooseberry, currant, raspberry, and ornamental plants were propagated for distribution to the settlers. *Gladiolus* bloomed abundantly and was highly esteemed.

[**Horticultural investigations at the New York State Station**] (*New York State Sta. Rpt. 1924, pp. 46-50*).—This is the usual annual report (E. S. R., 50, p. 539) containing brief progress notes upon the work of the year ended June 30, 1924. Grape fertilizer studies at Fredonia and Urbana continue to show that nitrogen is the only form of fertilizer returning a profit to grape growers.

Observations extending over a 12-year period upon budded and grafted apple trees showed no differences between the two. A comparison between apples topworked on Northern Spy and grown on their own roots indicated that own-rooted trees are preferable. Rome Beauty trees propagated from productive and unproductive parents showed, at 12 years of age, no differences that could be attributed to ancestry. The fact that Baldwin trees procured from 40 locations in the United States are producing fruits identical in size, color, season, and quality leads to the conclusion that, if there are distinct strains of this variety, such have not originated because of environmental differences due to geographical location.

[**Horticultural investigations at the South Carolina Station**] (*South Carolina Sta. Rpt. 1924, pp. 53-56, 57-59, figs. 3*).—Cooperative experiments with peach fertilizers have indicated that on both sandy and clay soils nitrogen is the limiting factor to tree growth. Applications of phosphoric acid and potash up to 10 per cent did not result in greater growth than was attained without the materials. With newly set trees, 0.5 lb. of nitrate of soda gave better growth results than did larger amounts. Heavy applications of nitrogen were observed to delay the ripening of fruit.

On sandy river bottom soil of rather poor quality, the maximum yield of marketable tomatoes was obtained with 1 ton of mixed fertilizer rich in phosphoric acid and organic nitrogen. Muriate of potash was found to be significantly more beneficial for the tomato than was sulfate of potash.

Variety tests of tomatoes, apples, and northern grapes are reported.

[**Horticultural work at the Brandon, Man., Experimental Farm in 1923**], W. C. McKILLICAN (*Canada Expt. Farms, Brandon (Man.) Farm Rpt. Supt. 1923, pp. 57-72*).—This report, composed principally of brief cultural and varietal notes on vegetables, reports the results of a test of the effect of pinching the leaders of staked tomato plants. No advantage was gained in earliness of fruiting where only one truss was allowed to fruit, while at the same time there was a heavy reduction in yield.

Report on commercial insecticides and fungicides (*Connecticut State Sta. Bul. 258 (1924), pp. 361-377*).—Like the preceding report (E. S. R., 49, p. 233) this paper is presented in two parts, the first of which comprises the text of the insecticide law of Connecticut and regulations for its enforcement, and the second part, by E. M. Bailey in collaboration with R. E. Andrew et al., contains the results of the examination of insecticides, fungicides, healthy and diseased tobacco plants, etc. In the case of the tobacco plants, the analyses of which were made for the benefit of the department of botany, diseased leaves were found to have in most cases a higher nitrogen and a lower carbohydrate content than healthy leaves. Allowing for the ash insoluble in acid, it is believed that diseased leaves are somewhat poorer in mineral constituents than are healthy leaves.

Orchard soil management, F. W. FAUROT (*Kans. State. Hort. Soc. Bien. Rpt., 37 (1922-23), pp. 56-60*).—Measurements of the increment of trunk growth in two apple orchards planted in 1919 and 1921 on rather poor soil at the Missouri Fruit Experiment Station, Mountain Grove, showed that cultural treatments have had very significant effects on growth. Those trees in the 1919 orchard receiving tillage, manure, sodium nitrate, and cover crops made

the greatest average annual gain, 1.91 in., as compared with 1.17 in. for the control trees where grass was cut but not gathered. In the 1921 orchard, where no fertilizers had been used, the best gain, 1.44 in. per year, was made by trees which were mulched with the grass cut in the interspaces. The check trees in this case made but 0.78 in. gain.

A preliminary report on Jonathan breakdown, P. M. DALY (*Sci. Agr.*, 5 (1925), No. 5, pp. 155-165, figs. 6).—Following the suggestion from practical growers that Jonathan breakdown is associated with the stage of maturity at which the fruit is harvested, in the fall of 1923 fruits were gathered twice a week, starting September 17 and ending October 27, from carefully selected trees located in five orchards in the Okanagan Valley, British Columbia. Approximately half of the fruit was stored at Summerland, and the rest, after preliminary holding at Kelowna, was forwarded to Ottawa and there placed in ordinary storage, ranging between 38 and 40° F.

In examinations made at Ottawa at approximately monthly intervals, it was found that of the 51 experimental trees involved, 38 bore fruit showing breakdown and 13 fruit absolutely free therefrom. Fruits picked prior to October 11 showed only one defective apple in 5,460 examined, indicating that the date of picking was a very important factor. Beyond October 11 an increasing percentage of breakdown was correlated with the advance of the picking season. That growing environments may have an important relation to breakdown in the Jonathan apple was shown in very significant differences in the amount of defective fruits from the several orchards. The fact that nonirrigated and irrigated trees bore fruit developing breakdown in almost equal quantities is deemed to indicate that soil moisture is not a contributory factor. Furthermore, soil fertility and the vigor of the trees could not be in any way associated with the trouble.

The author concludes that the results to date show that picking maturity is the main factor in the prevention of Jonathan breakdown, but warns that, because of seasonal fluctuations, no particular date for picking can be established, the stage of maturity being determined by actual examination of the fruit.

How to prune the young cherry tree, R. H. ROBERTS (*Wisconsin Sta. Bul.* 370 (1924), pp. 16, figs. 13).—In this well-illustrated bulletin there are presented concise, practical directions for pruning immature sour cherry trees, paying particular attention to the selection of the leader and the distribution of the principal scaffold limbs.

The grafting of American grapes, F. E. GLADWIN (*New York State Sta. Bul.* 520 (1924), pp. 3-18, pls. 6).—Following an earlier bulletin (E. S. R., 52, p. 443) outlining the results of grafting American grapes upon various stocks, the author herein discusses the methods and practices employed in grape grafting, pointing out the niceties of technique which are required to insure success. Failure in cleft grafting in the vineyard is thought due to several reasons, such as the use of incompatible varieties, unfavorable seasonal conditions, exclusion of air by wax or other similar material, and the presence of excessive moisture. The English whip-and-tongue graft was found especially satisfactory for bench grafting, using as stocks cuttings taken from one-year canes and as scions one bud pieces of the same diameter and of the desired variety.

Callusing was promoted by storing grafts in an upright position in wooden boxes lined with wet sawdust. Tests carried on for three years indicated that temperature is an important factor in callusing. In general, vinifera and southern United States varieties required more heat than did northern sorts.

The time required for callusing was found to vary with the seasons, indicating perhaps, an effect of stored foods. For example, in 1922 Iona, Campbell, Delaware, Worden, and Concord required 27 days, with a mean temperature of 76° F., while in 1923, 21 days at 70° were sufficient. In general conclusion, the author asserts that 50 per cent is a normal expectancy of survival in well-made and well-callused grafts of Concord and Catawba.

Cool storage of fruit: Report on experiments conducted during 1923 season. D. B. ADAM (*Jour. Dept. Agr. Victoria*, 22 (1924), No. 10, pp. 577-590).—A further report upon studies in fruit storage (E. S. R., 49, p. 437).

Records taken on Kieffer pears stored at 32 and 34° F. showed 88 and 75 per cent, respectively, of sound fruit after eight months' storage. The relation of the stage of maturity at harvest to blackening of the skin of Kieffers was indicated by 8, 7, and 23 per cents of discoloration for fruits gathered February 16 and March 2 and 24, 1923, respectively.

In the case of Jonathan apples harvested March 22 and April 17 from the same trees, then inclosed in ordinary paper wrappers, and stored at 32 and 36°, scald was much severer at both temperatures on the early picked fruits. Similar results were secured with Stone Pippin apples harvested April 18 and May 2 and stored at 34°. While oiled wrappers materially reduced the amount of scald on various varieties of apples they had no consistent effect on the development of Jonathan spot. A study of the relation of time of picking to the development of internal breakdown in Stone Pippin apples indicated, contrary to the findings of Daly, noted on page 538, that relatively immature fruits were more susceptible to this type of injury. An examination of Rokewood apples held six months at 32 and 37° showed somewhat more internal browning at the lower temperature. In the case of bitter pit, early picked Anne Elizabeth apples developed more injury in storage than did later gathered fruits. Rokewood apples moderately affected with water core regained their normal character after a few weeks in storage.

Observations on the keeping quality of oranges grown in different localities showed some differences in connection with the source. Tissue wrapped oranges, although keeping little better than control fruits, were more attractive in outward appearance.

Apricots stored at 37 and 35° developed more blue mold but were higher flavored than those held at 32°. Of three plums, Wickson, President, and Fellenberg, the President was found to be the best keeper.

In studies of peaches, Elberta did not keep at all satisfactorily, quickly becoming mealy and losing its flavor. Catherine Ann peaches held their original condition much better at 32° than at higher degrees, and a small shipment of this variety was successfully transported to London markets.

In storage tests with Bartlett (William's Bon Chretien) pears, 32° proved a more satisfactory temperature than either 34 or 36°.

Transportation of citrus fruit from Porto Rico. R. G. HILL and L. A. HAWKINS (*U. S. Dept. Agr. Bul.* 1290 (1924), pp. 20, figs. 8).—Records taken on four experimental trips from Porto Rico to New York City showed the possibility of cooling down a cargo of fruit approximately 15 to 27° F. during the voyage when the outside air and water temperatures ranged about 80°. The value of refrigeration in inhibiting rot development was shown in a comparative test of ventilation and refrigeration, the respective percentages of rot in the case of well-grown and well-packed oranges being 3.7 and 1. The average percentage of rot in refrigerated oranges, including both cultivated and uncultivated material, was 1.7. For grapefruit the average was less than 1 per cent. The value of refrigeration was more marked in the case of a lot of oranges

shipped in two vessels, one refrigerated and the other simply ventilated. The refrigerated fruit arrived in New York with no appreciable decay, while the ventilated showed 22 per cent injury.

The placing between the layers of boxes of strips of wood, called dunnage, enabled the air to circulate in the interior of the load and greatly facilitated the cooling of the fruit. In a test of three methods of stowage: (1) Dunnage between each layer, (2) between every second layer, and (3) no dunnage, the average temperature of the middle layers was reduced 14, 11, and 10°, respectively, during the trip from San Juan to New York. The authors conclude, therefore, that the use of dunnage for every layer greatly promotes the efficiency of refrigeration, and in general conclusion state that well-grown, carefully packed, and carefully stowed citrus fruits may be safely carried in refrigerated vessels from San Juan to New York City.

The coconut in Indo-China [trans. title], GUILLAUME (*Bul. Écon. Indochine*, n. ser., 27 (1924), No. 165, pp. 137-194, pls. 4, figs. 18).—A survey of the coconut-growing industry, discussing such details as distribution, botany, soils, cultural aspects, injurious insects, harvesting practices, and utilization, including manufacture of copra, oil, fibers, etc.

The coconut industry in Portuguese India, P. CORREIA AFONSO (*O Coqueiro: Produção, Indústrias, Comércio. Nova Goa, Portug. India: Dir. Serv. Agr., Florestais e Pecuários*, 1924, pp. 172+II, pls. 25).—This comprises general information concerning the extent and distribution of the industry and cultural and manufacturing practices.

Almond varieties in the United States, M. N. WOOD (*U. S. Dept. Agr. Bul. 1282* (1924), pp. 142, pls. 26, figs. 16).—Confusion in the nomenclature of the almond having led to the presence of a large proportion of inferior and unadapted varieties in California orchards, the author conducted a careful study of the varieties, both those commercially grown and those little known in the United States, and herein presents carefully detailed technical descriptions of varieties, with a key based on the characteristics of the nuts. The information is further enhanced by accurate drawings of the nuts and photographs of the bark and of the leaves. Early attempts at almond production in the United States, the present distribution in California, and the importance of choosing the best varieties are briefly discussed.

The book of gardens and gardening, edited by R. T. TOWNSEND (*Garden City, N. Y.: Doubleday, Page & Co.*, 1924, pp. [6]+106, pl. 1, figs. 293).—A symposium of illustrated articles relating to gardens, their arrangement, utilization, and management.

Gardens: A note-book of plans and sketches, J. C. N. FORESTIER, trans. by H. M. Fox (*New York and London: Charles Scribner's Sons*, 1924, pp. X+237, illus.).—An elaborate volume, probably of chief interest to the landscape gardener or architect, and consisting for the most part of copies of sketches of French and Spanish gardens with discussions of their principal features.

FORESTRY

Some factors affecting reproduction after logging in northern Idaho, J. A. LARSEN (*Jour. Agr. Research* [U. S.], 28 (1924), No. 11, pp. 1149-1157, figs. 5).—Records taken on a broad river bench at an elevation of 2,300 ft. in the Priest River Valley, Idaho, indicated that the amount of forest cover has a very important bearing upon soil and air temperatures and humidity. Three neighboring stations, (1) within a virgin mixed forest, (2) under approximately one-third overhead shade, and (3) on a fully exposed site, were

utilized. Air and soil temperatures in the open averaged from 7 to 8° higher than in the virgin forest, and were accompanied by lower humidity and higher evaporation, factors militating against the establishment on such sites of western white pine and other moisture-loving species. Large openings in the forest, bringing about as they do a change in the physical condition of the site, were observed to affect materially the character of reproduction.

Studies of the effect of the nature of the surface soil on the germination of western white pine seed showed the best total germination on the bare mineral soil and on partly burned duff, with the highest first-season germination on the deep ash area. A second germination test, in which western larch, Engelmann spruce, and western white pine were included, showed the larch and spruce to be somewhat better adapted to duff seeding than was the western white pine. Duff, however, was found subject to greater temperature and moisture fluctuations than the bare soil, and hence, for seedlings such as spruce, hemlock, and cedar, characterized by short and tender roots, was an unfavorable medium. Records taken on slopes of different exposure indicated that in full insolation soil surface temperatures often rise to a point practically prohibiting the establishment of seedlings of western white pine, cedar, and hemlock, thus explaining the general scarcity of these species on such open sites. It is suggested that a method of cutting which would provide smaller openings and partial shade would produce better silvicultural results.

A study of Douglas fir reproduction under various cutting methods, J. ROESER, JR. (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 12, pp. 1233-1242, pl. 1, figs. 3).—In testing the effects of four cutting treatments, namely, (1) clear, (2) none, (3) shelterwood, and (4) selection, upon reproduction in a typical Douglas fir forest located at the Fremont, Colo., Forest Experiment Station, it was found that the shelterwood system of cutting was decidedly the most favorable to reproduction, both in the number and in the size of the surviving seedlings. Reproduction counts in 1923, 10 years after cutting operations, showed 1,005, 1,237, 6,891, and 4,638 established seedlings per acre for the respective areas. As compared with earlier records, there was shown a steady gain for the clear-cut area and a steady loss for the virgin stand. Douglas fir was represented on the respective areas by 62, 57, 80.3, and 85 per cent of the total reproduction. The lack of soil moisture in the clear-cut and the uncut areas is believed to be the most limiting factor to Douglas fir reproduction. On the uncut area, in periods of drought the parent trees may easily become the seedlings' worst enemy.

On each of the three lumbered areas two methods of slash disposal, (1) scattering and (2) piling and burning, were compared in their relation to reproduction, leading to the conclusion that either method plays only a minor rôle, especially in the case of Douglas fir, the most important species. Humus, an obstacle to root penetration of seedlings, was found to be deepest in the open area, especially under the scattered slash.

The superiority of the shelterwood system of cutting was also shown in the comparative height of Douglas fir seedlings on the various areas. On the uncut area, the average height was 1.49 in., while on the shelterwood, clear-cut, and selection areas the average heights were, respectively, 3.53, 2.66, and 2.15 in. in the slash-scattered section and 3.12, 2.7, and 2.7 in. in the slash-burned sections. The figures are based on groups of from 40 to 341 seedlings of average ages varying from 5.4 to 6.05 years.

Fall sowing and delayed germination of western white pine seed, W. G. WAHLENBERG (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1127-1131, figs. 4).—Studies carried on at the Priest River Forest Experiment Station,

Idaho, and the Savenac nursery, Montana, have shown that fall sowing of western white pine seeds is much more satisfactory than spring sowing, the former resulting in prompt and satisfactory germination the succeeding spring, whereas spring sowing was generally unsatisfactory because of incomplete and delayed germination. Spring sowing usually resulted in uneven sized stands, which either required severe culling at the end of the second year or had to be left an extra year in order for the smaller plants to attain satisfactory size. Time of planting studies, in which sowings were made at frequent intervals from late August to November at the Savenac nursery, showed that the first two weeks in September is the most satisfactory period for planting western white pine seed at this location. Because of their early spring germination, thus affording opportunity for considerable development before the advent of hot summer weather, fall-sown beds did not require straw mulching or lath shading, operations both expensive and laborious.

Growth on cut-over and virgin western yellow pine lands in central Idaho. C. F. KORSTIAN (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1139-1148, pls. 3).—A study of mortality and increment on 16 sample plats representing both cut-over and virgin stands of western yellow pine, located in the Payette National Forest, Idaho, showed the cut-over areas to be in much the thriftier and more vigorous condition. Records taken over a 5-year period indicated that the cubic volume upon the cut-over areas had increased at the rate of 5.3 per cent per annum as compared with 0.6 per cent for the virgin stands, a difference believed to be due largely to the greater amount of bark-beetle injury, wind throw, mistletoe on Douglas firs, and suppression on the older stands, which consisted largely of ripe or very mature trees. The losses from death and decay thus practically nullified the annual increment. Observations on reproduction on several plats indicated the importance of sparing advance reproduction during logging, estimates indicating that otherwise as many as 20 years are often required to secure adequate restocking of poorer quality sites. The leaving of a few healthy seed trees still capable of making profitable growth further insures reproduction. Preferably such seed trees, except on wind-swept ridges, should be located singly, so that full advantage may be taken of light and satisfactory seed distribution assured.

The rôle of fire in the California pine forests. S. B. SHOW and E. I. KOTOK (*U. S. Dept. Agr. Bul. 1294* (1924), pp. 80, pls. 15).—An extended study of burned-over areas in the California pine forest region showed that, although fires in the virgin forest are rarely devastating, there is always a large amount of relatively inconspicuous and insidious injury, notably the killing of reproduction and the scarring of tree trunks, leading to their ultimate destruction. Furthermore, each succeeding fire apparently becomes more and more serious, until finally the scarred virgin forest becomes pure brush or chaparral, through the successive stages of a broken, patchy timber stand and brush fields containing isolated or small groups of trees.

An examination of fire-scarred trunks showed that fires have occurred in the California forests at approximate intervals of eight years for centuries, and undoubtedly have been a potent factor in determining the character of the forest. Inasmuch as highly inflammable pitch exudes from slight as well as severe wounds, light fires are considered potentially as serious to the welfare of the forest as are severe fires.

In respect to susceptibility to heat killing, western yellow and sugar pines were strikingly less susceptible than white fir or incense cedar, due to the inflammability of the white fir foliage and the low stature of the cedar. Quality of site was also a factor in heat injury, in that on the better sites the trees

were taller. Increment borings in crown-injured trees showed a growth reduction in direct relation to the extent of the injury. In correlating crown injury with height of fire-injured western yellow pine, it was evident that the degree of injury varied inversely with the total height of the trees. Concerning the relative susceptibility of species to crown injury, the western yellow and the sugar pines were found more resistant than Douglas fir or incense cedar. Insect and fungus injuries were found much more severe following burnings. Even the lightest of fires were found to have a disastrous effect on reproduction, especially on seedlings 2 in. or less in diameter. Observations on trees less than 4 in. in diameter showed the western yellow pine to be the most resistant to fire of four species, followed by sugar pine, white fir, and incense cedar. In general conclusion, the authors point out that every phase of the study indicates the incorrectness of the old conception that fire is beneficial to the California pine forests.

DISEASES OF PLANTS

[Plant disease investigations at the New York State Station] (*New York State Sta. Rpt. 1924, pp. 29-34*).—Summary reports are given of various investigations of plant diseases in progress at the station, including those on isolation and roguing and mosaic of potatoes noted on page 548.

Seeding beans as late as June 15 is said to have resulted in plants less susceptible to bacterial wilt than earlier plantings. The removal of flowers and pods seemed to delay attacks of bacterial wilt, and it is believed that susceptibility is associated with translocation of nutrients within the plant.

The application of fungicides to soil is said to have controlled China aster diseases so far as they are due to fungi which occur near the surface of the soil. It did not, however, control those which attack the roots deep in the soil.

Summary accounts are given of investigations in cabbage seed bed diseases and Delphinium root rots (E. S. R., 52, p. 50), and cauliflower diseases on Long Island (E. S. R., 51, p. 152). More recent investigations of cauliflower diseases are said to indicate that black rot is generally present in the seed and is usually introduced in the field by means of the seed. Investigations are said to be in progress on methods of seed treatment adapted to Long Island conditions.

An account is given of the dying of fruit trees in the Hudson Valley, observations having been made on about 200 separate lots of trees. The disease is not confined to the Hudson Valley, and the preliminary results indicate that it is due to many causes not definitely mentioned.

In the study of apple diseases in the Hudson Valley, an attempt was made to control the Phoma or Brooks' fruit spot of apples by spraying and dusting. Owing to the absence of disease in the orchards under experiment, no definite results were obtained.

Spraying experiments for scab were carried on in two orchards, and in connection with these experiments the discharge of the ascospores of the fungus was studied and the periods of infection in the spring determined.

Notes are given on raspberry disease investigations, particular attention being paid to mosaic and wilt. Experimental plantings made in the spring of 1923 of mosaic-free stock are said to show considerable mosaic, and to make it doubtful whether the roguing method of control can be made successful. The success of roguing is thought to be connected with the control of the aphid which is responsible for its spread. Preliminary studies on the running out of black raspberries are said to indicate that probably the wilt due to *Verticillium albo-atrum* is an important factor.

Plant diseases (*South Carolina Sta. Rpt. 1924, pp. 48-51*).—As an outcome of a plant disease survey, it is reported that there were observed in South Carolina an *Ascochyta* canker of cotton, which was first reported in Arkansas (E. S. R., 47, p. 447), and another destructive cotton disease, the cause of which has not been definitely determined.

The nematode disease of wheat was found in the northwestern part of South Carolina in May, 1924.

Previous work of the station on cotton anthracnose has shown that infected seed become free from the fungus if kept in storage long enough (E. S. R., 36, p. 646). Subsequent studies were carried on in an effort to find means of hastening the death of the fungus, but the results thus far do not seem to be very promising in this respect.

A bacterial pod spot of peas is reported, in which the organism has been isolated and the disease reproduced. The organism is being studied preliminary to a detailed publication.

A disease of wild onions, which is said to be exterminating that plant in one of the counties in South Carolina, is reported. The fungus responsible for the disease is as yet undescribed.

Plant pathology, C. D. SHERBAKOFF (*Tennessee Sta. Rpt. 1923, p. 27*).—In a study of wheat deterioration attempts have been made to determine the varietal susceptibility and resistance to root rots, scab, and black chaff. Field tests are said to have shown a marked difference in the degree of susceptibility of different varieties to scab and possibly to black chaff.

A study of the fusaria causing wilt of economic plants in Tennessee has been continued, and information has been obtained on the morphology and physiology of the species of *Fusarium* occurring on tomatoes, potatoes, soy beans, and other plants. Studies of *F. moniliforme*, a common corn parasite, are said to indicate that this fungus, although occurring on corn seed, has little effect on the yield of corn, under conditions of the author's experiment.

[**Plant diseases, Mysore, 1922-23**], K. V. ANANTARAMAN (*Mysore Dept. Agr. Rpt., 1922-23, pp. 1, 2*).—In this report it is stated that areca nut koleroga, which is spreading, caused heavy losses during the year, being favored by rains, which did not, however, prevent an increase of the area sprayed to 1,200 acres as against 750 acres in 1921-22. Further studies on sandal spike proved beyond doubt that root connections constitute one means of spreading the disease. The hibernating stage of coffee black rot was found, and ragi smut and betel and grapevine mildew received attention.

[**Report of mycological section, Mysore**], H. V. KRISHNAYYA (*Mysore Dept. Agr. Rpt., 1922-23, pt. 1, p. 4*).—The facts above noted regarding koleroga, coffee black rot, ragi smut, and sandal spike are referred to, emphasizing the need and value of adding to the spray for koleroga a casein adhesive. The addition of this spreader to Bordeaux mixture has been found effective also against grapevine mildew.

Report of work done in the mycological section during 1922-23 [Mysore], M. J. NARASIMHAN (*Mysore Dept. Agr. Rpt., 1922-23, pt. 2, pp. 13-15*).—Losses due to koleroga of areca nut were heavy where spraying had not yet been resorted to or where the work was hindered by continuous rain. Extension of work testing casein as an adhesive showed that 0.5 lb. to 25 gal. of spray mixture was efficient even in spite of the heavy rainfall of the Ghat areas.

A disease similar to koleroga was observed to cause the fall of all the leaves. A similar disease was observable on plants common around the garden, as *Bryophyllum calycinum*, *Colocasia antiquorum*, and wild fig.

Areca nut root disease (*Thielaviopsis* sp.) was brought into pure culture and inoculated into healthy trees, and the results of these experiments are awaited.

Coffee black rot was studied, and the hibernating stage was found. A number of wild plants are attacked by a disease apparently similar. Coffee die-back was severe. Lime applications had no good effect.

Smut on seeds of *Eleusine coracana* was apparently eliminated in one experiment by the use of copper sulfate, copper sulfate and lime, or formalin. Betel vine mildew has done no severe damage since the spraying of August, 1922.

Bordeaux mixture in December at 5-5-50 strength with casein was effective against grapevine mildew, as also against leaf rust (*Uredo vialae*) and fruit rust. Banana fruits and stems inoculated with *Thielaviopsis* sp. showed local discoloration and lack of development.

Root connections have been shown by exposure and photography to cause spike in sandal. Spiked sandal is often associated with spiked *Zizyphus*.

A new method of obtaining mosaic "virus," J. JOHNSON and M. MULVANIA (*Science*, 60 (1924), No. 1540, p. 19).—The authors found by submitting the root system, or the end of a cut stem, to a pressure of about 100 lbs. the contents of the vascular bundles could be forced out of the plants and collected with capillary pipettes or medicine droppers. When a succulent mosaic plant with hydathodes was so treated it yielded considerable quantities of liquid water containing the infectious principle, though apparently the virus was not as concentrated as when secured from crushed tissue. A comparative microscopic study of the liquid exuded from healthy and diseased plants did not lead to any conclusive results as to the presence of an organism.

Virus obtained in this way is considered to approximate closely the virus obtained by sucking insects, and the method is considered useful for cross-inoculation studies.

Aecial stages of the leaf rusts of rye, *Puccinia dispersa* Erikss. and Henn., and of barley, *P. anomala* Rostr., in the United States, E. B. MAINS and H. S. JACKSON (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 11, pp. 1119-1126, pl. 1).—The authors report that the leaf rust of rye is able to produce aecia on species of *Anchusa* in the United States. *A. officinalis* and *A. capensis* were found to be quite susceptible. *Nonnea rosea* was infected occasionally, with production of pycnia only. The other boraginaceous species tested remained uninfected. *A. capensis* was found naturally infected by the leaf rust of rye, and it is thought that it may become of some importance in the spread of the disease. The teliospores of the leaf rust of rye are said to be capable of overwintering in the United States, and may germinate the following spring.

The leaf rust of barley, *P. anomala*, was found to develop aecia on *Ornithogalum umbellatum*.

Relative resistance of wheat to bunt in the Pacific Coast States, W. H. TISDALE, J. H. MARTIN, ET AL. (*U. S. Dept. Agr. Bul.* 1299 (1925), pp. 30).—The results are given of studies at Davis, Calif., Moro, Oreg., and Pullman, Wash., of nearly all of the commercial varieties of wheat grown in the United States, as well as numerous foreign wheats and selections from other domestic varieties. Seed of the different varieties and strains was smutted by the spores of *Tilletia tritici* and planted in nurseries at the above stations during two seasons.

Nearly all the varieties of American wheats, all but one of the Australian wheats, and all of the Indian and South African wheats tested were found more or less susceptible to bunt. Of the four commercial classes of common wheat, the hard red winter wheats were found the most resistant, and the white wheats were as a class the most susceptible. The hard red spring and soft

red winter varieties were somewhat intermediate in susceptibility, but one of the soft red winter varieties proved highly resistant. The club wheats as a rule proved the most susceptible to bunt. Durum, Polish, and poulard wheats, as well as emmer and spelt, were in general somewhat more resistant than the common wheats, except hard red winter.

The varieties and strains proving to be immune or highly resistant are enumerated, and their probable value for further hybridization work and for commercial planting is indicated.

The present status of the hot water treatment in Indiana, C. T. GREGORY (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 315-318).—It has been shown that presoaking is one of the essential steps in the treatment of loose smut in wheat. Presoaking for 4 hours is sufficient, and 12 hours' soaking may cause germination. Not more than 1 bu. of dry wheat should be soaked in a 2-bu. burlap sack on account of swelling. Where large amounts of wheat are treated a device has been used, consisting of a heavy wire drum holding 5 bu. of soaked wheat, which revolves in a large tank of water heated by steam. A device enabling the operator to keep the wheat in the hot water without burning his hands consists of loops of heavy twine fastened by a slip noose to the mouth and one corner of the sack.

The time of treating and the temperature of the water have not undergone any change. Temperatures as high as 135° F. will not injure wheat, and it is known also that immersion at 130° for 15 minutes will not do any particular harm to the seed. It has been found that it is necessary only to surface dry the grain so that it will run through the drill without clogging.

Usually the stand of the treated wheat is rather thin, but the plants stool much more than the untreated wheat, so that the final number of heads produced is about the same in both cases. Generally the heads in the treated wheat are much more uniform in size and are usually somewhat larger than in the untreated. The treated wheat will usually ripen about a week later than the untreated wheat, but this is not objectionable. The hot water treatment as a means of ridding the wheat of cockle can not always be depended upon.

It has been demonstrated in Knox and Shelby Counties that a widespread use of treated seed will greatly reduce the dangers of the spread of smut. The best way to handle this problem is to establish smut-free areas or communities.

Chemical eradication of the common barberry, N. F. THOMPSON (*U. S. Dept. Agr., Dept. Circ. 332* (1924), pp. 4).—Suggestions are given for the destruction of the common barberry by the use of salt or kerosene. The advantages and disadvantages of each chemical are pointed out.

Differences in the susceptibility of clover to powdery mildew, E. B. MAINS (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 307-313, fig. 1).—The mildew of red clover (*Trifolium pratense*) is apparently specialized on that host, crimson (*T. incarnatum*), alsike (*T. hybridum*), and white (*T. repens*) not being infected. Considerable differences are shown among red clover varieties as to mildew susceptibility, American varieties being much more susceptible than European. Resistant individuals in various numbers are probably to be found in all varieties. Selection and breeding for resistance offer the best means for controlling the disease.

Transmission of cowpea mosaic by the bean leaf-beetle, C. E. SMITH (*Science*, 60 (1924), No. 1551, p. 268).—Preliminary experiments carried on during 1921 indicated that the bean leaf beetle (*Ceratoma trifurcata*) transmitted the cowpea mosaic. Subsequent investigations have confirmed this

previous conclusion, and it was established that insects which were fed for one day on diseased plants and then transferred to healthy plants transmitted the disease in practically every case.

The "mosaic disease" of the hop, E. S. SALMON (*Jour. Inst. Brewing*, 29 (1923), No. 11, pp. 882-889).—As part of the sixth report on the trial of new varieties of hops, an account is given of an outbreak of leaf mosaic at the research station, East Malling, with discussion of the question as to whether the new variety M45 is a carrier of the mosaic disease.

"The cause of 'mosaic' and 'nettlehead' diseases is probably to be attributed either to a virus or to an ultramicroscopical organism carried in the sap of the hop plant and transmitted from diseased to healthy plants by aphids. . . .

"With our present knowledge, therefore, it is clearly inadvisable to plant M45 in the immediate neighborhood of commercial varieties which are susceptible to the 'mosaic' disease. It is possible that it will prove safe to grow M45 with the Fuggles variety, since the latter, although subject to the 'nettlehead' disease, appears to be resistant to the 'mosaic' disease."

Potato leaf roll in Indiana, M. W. GARDNER and J. B. KENDRICK (*Indiana Sta. Bul.* 284 (1924), pp. 23, figs. 7).—This bulletin treats of the nature and behavior of potato leaf roll under Indiana conditions, and gives an account of investigations on the effect of disease on yield, its spread in the State in different seasons, and the relative susceptibility of various commercial varieties.

The authors report that under Indiana conditions it is practically impossible to recognize leaf roll plants in the late crop with any degree of certainty, but the presence of the disease is readily revealed by growing the second generation in the greenhouse. By testing in the greenhouse one eye each from tubers sent in from various counties, it was found that the disease was widespread and prevalent in the State, particularly in low-yielding stocks. In field plats in a number of regions of the State, the yield from rows planted with leaf roll tubers was from 22 to 66 per cent less than that from healthy tubers. In 1923 the infection was more extensive than in the previous year, and in 1922 the disease was more prevalent than in 1921.

Recent investigations showed that the disease decreased with increasing distance from the source of infection, although considerable infection occurred at a distance of 75 ft. Recently infected hills were found to produce tubers, some of which yielded leaf roll and some healthy plants in the greenhouse tests. The varieties Early Ohio and Irish Cobbler proved susceptible in field plats, but not as susceptible as the Rural New Yorker. The variety Bull Moose was also found to be very susceptible. While the use of leaf roll seed tubers was found to reduce the yield, it was found that as a rule this was not true of current season infection.

From the authors' investigations it is concluded that leaf roll can not be detected with certainty in the field and that current season infection does not decrease the yield, rendering it practically impossible to eliminate the disease from seed fields. As a means of practical control, the authors recommend the use of seed stocks grown in regions where the disease does not spread or where it may be eliminated by field inspection.

Pythium rootlet rot of sweet potatoes, L. L. HARTER (*Jour. Agr. Research* [U. S.], 29 (1924), No. 1, pp. 53-55, pl. 1).—A description is given of a *Pythium* rootlet rot of sweet potatoes which is said to occur quite commonly in hotbeds in various parts of the country. The disease is apparently due to species of *Pythium* of the *debaryanum* type. It apparently begins at the end of the small

rootlets and works progressively toward the main roots. All 21 varieties tested were found susceptible to the disease, but not to the same degree.

Control of leafroll and mosaic in potatoes by isolating and roguing the seed plat, F. C. STEWART (*New York State Sta. Bul. 522 (1924), pp. 3-14*).—The results are given of an experiment carried on at the station during five seasons in which an attempt was made to rogue the plats for leaf roll and mosaic. It was found difficult to rogue properly, and as a result there was in the fifth season 15.5 per cent of leaf roll in stock which was practically free from leaf roll at the beginning of the experiment.

An experiment on the control of mosaic by roguing was conducted at Malone, in the northern part of the State, during three seasons. It was begun with greenhouse-tested seed thought to be mosaic-free, yet the crop of 1923, when tested in the greenhouse, was 4.4 per cent mosaic.

As a result of these experiments, the author concludes that isolation and roguing of the seed plat can not be depended upon to control satisfactorily either mosaic or leaf roll, or even to prevent potatoes from running out with the latter disease under certain conditions. Nevertheless, the practice is recommended as a helpful one.

Experiments are said to show that the tuber-index method of testing tubers for mosaic in the greenhouse is an excellent one for obtaining mosaic-free seed with which to start a seed plat.

Growing disease-free seed potatoes (*New York State Sta. Bul. 522, pop. ed. (1925), pp. 4*).—A popular edition of the above.

The sugar cane disease situation in 1923 and 1924, C. W. EDGERTON, W. G. TAGGART, and E. C. TIMS (*Louisiana Stas. Bul. 191 (1924), pp. 3-44, figs. 8*).—According to the authors, the seasons of 1923 and 1924 were unfavorable to sugar cane growing in Louisiana, that of 1923 being exceptionally wet and 1924 extremely dry. Cane borer infestation was very heavy in 1923, and this was accompanied by severe infection of red rot. The three diseases which had a detrimental effect on the crop are said to be red rot (*Colletotrichum falcatum*), mosaic, and root rots, due to species of *Marasmius* and *Rhizoctonia*. The red rot is said to have decreased the sugar content of the juice in 1923, and materially hurt the germination of the buds. Mosaic has been found to decrease the vigor of the cane, and is considered responsible for considerable losses. The oldest infected districts, however, were not the ones showing the poorest crop conditions. Root rots aided by weather conditions were very important, the diseases appearing in practically every section in the State. Some varieties of cane have been found to be less subject to infection, and these are being propagated for general planting. The selection of healthy seed cane is advocated in order to free canes gradually from excessive root rot infection and to reduce loss from mosaic.

Phytophthora rot of tomato, eggplant, and pepper, J. B. KENDRICK (*Ind. Acad. Sci. Proc., 38 (1922), pp. 299-306, figs. 2*).—A *Phytophthora* rot of tomato, eggplant, and pepper fruits occurred in a field at Lafayette, Ind., in 1921, being repeatedly isolated also from diseased fruits. Successful inoculations were secured on eggplant and pepper with the fungus isolated from tomato, and subsequent reisolations from inoculated fruits were made. The symptoms on tomato resemble very closely tomato buckeye rot as described by Sherbakoff (*E. S. R., 38, p. 251*), and the fungus agrees morphologically with *P. terrestris*. Under field conditions, natural infection of immature, uninjured, green tomato fruits occurred.

The control of tomato leaf-spot, F. J. PRITCHARD and W. S. PORTE (*U. S. Dept. Agr. Bul. 1288 (1924), pp. 19, pls. 2, figs. 9*).—The results are given of experiments carried on for the control of tomato leaf spot due to *Septoria*

lycopersici. According to the authors, the use of Bordeaux mixture or other copper sprays has given effective control, but the profits from spraying are variable and not always sufficient to justify the expense. It is believed that a more effective and economical method of control lies in the use of modified field practices. It is claimed that leaf spot epidemics can be largely avoided by setting out large, stocky, well-hardened plants early in the spring. The fungus is said to overwinter in old tomato vines, and plowing them under in autumn will largely prevent the reappearance of the disease. The fungus, however, grows and produces spores on various weeds, grasses, and the remains of various crops, especially cornstalks, and these should be destroyed or covered with soil by plowing.

"Sleepy disease" of the tomato, W. F. BEWLEY (*Jour. Min. Agr. [Gt. Brit.]*, 30 (1923), No. 5, pp. 450-457, pl. 1).—The term "sleepy disease" as commonly used in Great Britain covers a number of separate diseases, the most important of which is Verticillium wilt. The other diseases under this general title include Fusarium wilt and a root rot caused by *Vermicularia varians*. These are discussed as related to temperature, soil, and control.

Fire blight, J. A. McCLINTOCK (*Tennessee Sta. Rpt. 1923*, p. 25).—In connection with investigations of fire blight, inoculations with pure cultures of the organism were made in varieties of pears, quinces, and apples of known or reported resistance to fire blight. From the data collected, it appears that seedlings of known resistant stocks, open fertilized in an orchard containing some susceptible varieties, showed a high degree of resistance, indicating that this factor is dominant.

Grape diseases, with special reference to black-rot and anthracnose, A. S. RHOADS (*Fla. State Plant Bd. Quart. Bul.*, 8 (1924), No. 4, pp. 102-112).—Brief accounts are given of black rot and anthracnose, which are known to occur on the Carman and other grapes in Florida, as regards history, symptoms, causal organisms (*Guignardia bidwellii* and *Sphaceloma ampelinum*, respectively), and control measures.

Ripe-rots of grapes and the copper acetates as non-staining sprays for late applications to control them, A. S. RHOADS (*Fla. State Plant Bd. Quart. Bul.*, 8 (1924), No. 4, pp. 97-102).—Owing to the prevalence of humid or rainy weather during the ripening period in Florida, grapes are subject to considerable damage from at least three widespread diseases, bitter rot (*Melanconium fuligineum*), white rot (*Coniothyrium diploidiella*), and anthracnose due to *Glomerella cingulata*. Bitter rot and white rot are the more important, since they often attack early the stem of the cluster, its branches, or the stalks of the berries. Bordeaux mixture spots the fruit. Burgundy mixture or cuprammonium sprays tend to cause burning. Insufficient trial has been made of a neutral mixture of copper and caustic soda.

"The copper acetates, on the other hand, form even less conspicuous deposits than the cuprammonium sprays and, for the equivalent amount of copper, are many times less injurious to the plant sprayed. They compare favorably with Bordeaux mixture as regards effectiveness. They present in addition the important practical advantages of not burning the foliage, freedom from nozzle trouble, and are very convenient as regards the making up of spray mixtures."

The merits are discussed of basic copper acetate (verdigris) and of neutral or normal copper acetate. The latter always requires the addition of gelatin to increase adhesiveness, and the former is improved by it.

"Despite the greatly increased cost of the copper acetates as compared to copper sulfate the basic copper acetate or verdigris is by no means prohibitive in price when its value for a final application on the ripening grapes is considered."

Department of citrus canker eradication.—Report on eradication work in cooperation with the Bureau of Plant Industry, U. S. D. A., for quarter ending June 30, 1924, [F. STIRLING] (*Fla. State Plant Bd. Quart. Bul.*, 8 (1924), No. 4, pp. 115, 116).—Accounts and tabulations previously noted (*E. S. R.*, 51, pp. 155, 156), as now brought up to the middle of 1924, show that citrus canker has been found in 22 Florida counties; grove trees infected since May, 1914, numbering 15,151; nursery trees infected, 342,260; properties, 510; and properties still classed as infected June 30, 1924, 9. No citrus canker outbreak has been noted since the one isolated case appearing in October, 1923.

Chestnut trees surviving blight, A. P. KELLEY (*Science*, 60 (1924), No. 1552, pp. 292, 293).—The results are given of studies of areas containing chestnut trees in which the second growth and seedlings have produced a greater amount of growth than that killed during the same year. Not only were saplings found that were recovering but older trees as well. Similar observations have been made elsewhere, and it is believed that the improved condition may not be due wholly to greater resistive powers but to a lessened supply of spores of *Endothia parasitica*. Some trees have also shown their ability to heal serious cankers.

Preliminary note concerning physiological specialization in *Fomes pinicola*, H. SCHMITZ (*Science*, 60 (1924), No. 1550, pp. 248, 249).—A report is given of results obtained from a physiological study of four cultures of *F. pinicola* obtained from four different hosts, namely, Douglas fir (*Pseudotsuga taxifolia*), white fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), and western white pine (*Pinus monticola*). The results obtained are said to show that these four strains differ very markedly in their characteristics of growth, rate of growth, extracellular enzyme activity, intracellular enzyme activity, effects produced in mixed cultures, growth on liquid media, and nitrogen relations.

Survey of blister rust infection on pines at Kittery Point, Maine, and the effect of *Ribes* eradication in controlling the disease, G. B. POSEY and E. R. FORD (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 12, pp. 1253-1258, figs. 5).—According to the authors, there was in 1916 an outbreak of white pine blister rust in York County, Me., which was traced to a planting in 1897 of cultivated black currants from England. An investigation showed that cultivated black currants were mainly responsible for the spread of the infection to pines, the amount of infection being in proportion to the nearness of stands of white pine. The highest degree of infection was in the path of late summer and autumn storms. The rate of infection increased from 1900 to 1916, and it was most severe on the larger sized pine trees where the stand was understocked and among the dominant trees. The destruction of all *Ribes* in an area of six square miles prevented the occurrence of new pine infections and permitted the restocking of the area with disease-free pine seedlings.

South American leaf disease of Para rubber, R. D. RANDS (*U. S. Dept. Agr. Bul.* 1286 (1924), pp. 19, pls. 6, fig. 1).—An account is given of a leaf disease of Para rubber caused by *Dothidella ulei*, the information being based on recent observations and the published work of others, among them reports by Stahel and Bancroft (*E. S. R.*, 38, p. 153).

Spike disease of sandal, B. N. IYENGAR (*Mysore Dept. Agr. Rpt.*, 1922-23, pt. 2, pp. 10-12).—During the year, clear experimental evidence was obtained for the first time regarding root transmission of sandal spike disease. Of healthy seedlings five years old, having good root development and haustorial connections, one in each group was grafted with spike in July, 1921. Two months later the disease appeared in the grafted trees. One of the other trees

showed the disease in July, 1922, this whole tree a month later bursting out all over with spike, which by that time had appeared in two other trees. A detailed account by Coleman is noted below.

An elaborate series of experiments bearing upon formation rate showed that carbon dioxide absorption rate in spiked leaves is always less per unit area than in normal leaves. Of diseased trees, only one, treated the year before with potassium chloride, was still alive. Other supposed differences between sound and spiked trees are being tested out. Oils from both sound and spiked trees satisfy the requirements of the British Pharmacopoeia.

The transmission of sandal spike, L. C. COLEMAN (*Indian Forester*, 49 (1923), No. 1, pp. 6-9, pls. 3).—Since the publication of the author's 1917 bulletin (E. S. R., 38, p. 855), the staff of the Agricultural Department of India has been engaged in an investigation of spike in sandal. Of the information collected, the present account details chiefly some results regarding the natural spread of the disease.

Of numerous grafting experiments not one shows a case where a diseased scion established connection and grew without transmitting spike to the stock and finally killing the tree. Where no connection was formed, no spike appeared on the stock, however severely it was cut back.

It is considered as safe to conclude from the evidence obtained that the disease in nature is transmitted only through the roots or the portion above ground, that the haustoria do transmit the disease, and that there is no external cause for sandal spike disease.

It appears to the author unlikely, however, that the natural transmission of sandal spike takes place only through the haustoria. Much information on this point has appeared in regard to similar diseases in other parts of the world, insects often playing a part in such diseases, though not yet proved to carry spike disease.

On some plant parasitic nemas and related forms, G. STEINER (*Jour. Agr. Research* [U. S.], 28 (1924), No. 11, pp. 1059-1066, pls. 4).—Notes are given of *Cephalobus subelongatus* on green leaves of *Phlox drummondii*; the occurrence of *Heterodera radiculicola* on roots of the African sausage tree, *Kigelia pinnata*; on the chrysanthemum nema, *Aphelenchus ritzema-bosi*, and its occurrence in the United States; on the food habits of *Dorylaimus regius*; and the infestation of Zinnia roots by *Paratylenchus nanus*.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Principles of animal biology, A. F. SHULL (*New York and London: McGraw-Hill Book Co., Inc.*, 1924, 2. ed., [rev.], pp. XVIII+422, pls. 2, figs. 269).—This is a second edition of the work by Shull, with the collaboration of G. R. Larue and A. G. Ruthven. The several chapters deal with the subject as follows: Introduction (pp. 1-24), morphology of the cell (pp. 25-38), physiology of cells (pp. 39-61), cell division (pp. 62-76), the origin of the Metazoa (pp. 77-96), morphology of higher types (pp. 97-132), physiology of organs (pp. 133-153), reproduction (pp. 154-175), the breeding habits of animals (pp. 176-191), embryonic development (pp. 192-222), genetics (pp. 223-245), classification of animals (pp. 246-264), the animal and its environment (pp. 265-280), geographic distribution (pp. 281-301), fossil animals (pp. 302-332), and evolution (pp. 333-357). A glossary of 43 pages is included.

The European hare (*Lepus europaeus pallas*) in North America, J. SILVER (*Jour. Agr. Research* [U. S.], 28 (1924), No. 11, pp. 1133-1137, fig. 1).—The European hare was introduced and liberated first in 1888 at Jobstown, N. J., but more successfully at Millbrook, Dutchess Co., N. Y., in 1893 and

later. It now occurs from southern Vermont to central New Jersey, and eastward 20 or 30 miles into Connecticut and Massachusetts, and to a limited extent westward across the Hudson and Delaware Rivers into extreme eastern Pennsylvania. Complaints of serious injury to young fruit trees in the Hudson River Valley of New York led to field investigations by the U. S. D. A. Bureau of Biological Survey in 1916 and 1918. Questionnaires were issued in 1922, and the facts gathered have shown that the European hare is steadily increasing in numbers and gradually widening its range. Its only serious injury is to young orchard trees, which takes place during severe winter weather, when its natural food is not readily obtainable. A decided preference is shown for apple trees, although slight injury may be done to shade trees, ornamentals, shrubbery, small fruit bushes, etc. In addition to shooting, control measures include the use of woven-wire fences, individual tree protectors, repellent washes, and winter feeding. Poultry netting 30 in. high, of 1-in. mesh, encircling the tree is one of the best of the mechanical protectors.

Revised encyclopedia of canaries (Louisville, Ky.: Audubon Pub. Co., 1924, pp. 89, figs. 26).—Twelve varieties are described and illustrated in this work on the breeding of canaries for pleasure and profit.

The kea or mountain-parrot, J. G. MYERS (*New Zeal. Jour. Agr.*, 29 (1924), No. 1, pp. 25-35, fig. 1).—An account of the sheep-killing parrot, *Nestor notabilis* Gould.

Notes on the habits and life-history of the Indian glow-worm: An enemy of the African or Kalutara snail, J. C. HUTSON and G. D. AUSTIN (*Ceylon Dept. Agr. Bul.* 69 (1924), pp. 15, pl. 1).—This is a report of studies of *Lamprophorus tenebrosus* Wlk., which first came under the special observation of the senior author in 1920.

Agricultural entomology and parasitology, G. GUÉNAUX (*Entomologie et Parasitologie Agricoles*. Paris: J.-B. Baillière & Son, 1922, 4. ed., rev. and enl., pp. VIII+592, figs. 427).—The several parts of this handbook deal with the subject as follows: I, Protozoa, particularly Sporozoa (pp. 5-10) and Flagellata (pp. 10-12); II, Vermes, including Platyhelminthes (pp. 13-38), Nematelminthes (pp. 39-72), and Annelida (pp. 72-77); III, Mollusca (pp. 78-84); IV, Arthropoda, including Insecta (pp. 85-533), Myriapoda (pp. 534-539), and Arachnida (pp. 539-574).

[Report of the New York State Station] division of entomology (*New York State Sta. Rpt.* 1924, pp. 39-46).—This is a brief statement on the entomological work of the year.

In an orchard at North Rose the fruit-tree leaf-roller is the most important insect pest met with. Its eggs commence to hatch normally during the prepink stage in the spraying schedule, but during some seasons larvae continue to emerge over a period of from four to six weeks. Oil sprays do not appear to be wholly dependable. A marked improvement in the condition of plats thoroughly sprayed with arsenicals, applications having been made at rather short intervals during the period when the eggs were hatching, was an important result of the experimental work. As a result, there was little or no injury by the caterpillars to the blossoms and fruit clusters, and the damage to the terminal growth was negligible. Extensive injuries by the codling moth in the Great Lakes region of the State led to investigations of the habits of the insect, which relate to initial and maximum oviposition of the first brood.

The pear psylla is effectively held in check by timely and thorough applications of spray mixtures, but the difficulty experienced by owners of large pear orchards in carrying out the spraying schedule led to investigations of its susceptibility to dust mixtures and their utility when employed to supplement

spraying operations. Work with the grape leafhopper indicates that proper spraying with nicotine sulfate is more certain and cheaper than treatment with nicotine dusts, but further work is necessary before definite conclusions can be drawn.

In control work with the striped cucumber beetle, the spray consisting of lead arsenate 5 lbs., Kayso 5 lbs., and water 100 gal. has given better results than dust mixtures, such as lead arsenate 1 lb. and gypsum 20 lbs., due principally to the fact that the injury of the ingredients to the plant was less. The use of nicotine dust against the striped cucumber beetle has not given satisfactory results, due chiefly to unfavorable weather conditions at the time of application. Unfavorable weather conditions are said to have led to injury of cauliflower, Brussels sprouts, and radish in the seed bed by corrosive sublimate treatment applied for the cabbage maggot. The effectiveness of tobacco dust of 200-mesh grade for control of thrips and aphids in the cauliflower seed bed is said to have been demonstrated.

In field studies, it was determined that the winged migrants of the green peach aphid are largely the progeny of colonies on the potato. Soap was found to be very satisfactory as a fall spray against the pear psylla in the Hudson River Valley.

Insect pests (*South Carolina Sta. Rpt. 1924, pp. 43-48*).—Brief notes are given on several new materials, including nicotine preparations and combinations of nicotine sulfate with calcium arsenate, as tested in the laboratory with a view to discovering substances of high toxicity in a search for control measures for the cotton boll weevil and the cotton aphid. A brief reference is made to the occurrence of the Mexican bean beetle in South Carolina and means for its control.

A type of injury to cotton plants, apparently new, which appeared during the summer, was found to be very largely caused by the cotton flea (*Psallus seriatus* Reut.). This injury was observed early in the season when certain growers were examining cotton for the first signs of boll weevil activity. The injury is characterized by the young terminal bud and terminal leaf withering, turning black, and dropping from the plant, as a result of which the squares fail to develop. Severe infestation resulted in the failure of the plant to fruit. The damage to cotton usually occurred in rather localized areas, although more or less injury sometimes occurred throughout large fields. The insect appears to be somewhat migratory in habit, feeding upon the more succulent plants of an infested field and migrating to other sections after the buds of the infested area had been killed or the plant growth retarded. The damage first appeared in the coastal section of the State and spread gradually northward and westward. The central and eastern portions of the State suffered the most severe damage, the injury being of little consequence west of Anderson.

Entomology [studies at the Tennessee Station], S. MARCOVITCH (*Tennessee Sta. Rpt. 1923, pp. 24, 25*).—In studies of the strawberry root aphid, the relative length of daily light exposure rather than temperature is the most important factor in influencing the appearance of the sexes. A daily exposure of strawberry plants for 7.5 hours, beginning February 23, caused the sexes of strawberry root aphid to appear on May 7 and eggs to be deposited May 22, whereas normally the sexes do not make their appearance until November. By giving the cabbage aphid on curled dock and *Capitophorus hippophaes* on smartweed a short day exposure, fall migrants were made to appear during the latter part of May and early June, whereas normally they do not make their appearance until October. In life history studies of the woolly aphid, the author has found that the elm is its principal host in Tennessee, as first reported by Patch from Maine (*E. S. R., 36, p. 755*).

[Contributions on economic insects] (*Ztschr. Angew. Ent.*, 10 (1924), No. 1, pp. 270, pls. 2, figs. 27).—The papers here presented (E. S. R., 50, p. 255) relating to insects of economic importance include the following: Repression of the More Important Forest Insects by Palearctic Birds, by A. F. von Vietinghoff von Riesch (pp. 1–55); Mechanical Trap Control Experiments with *Meligethes aeneus* F., by H. Blunck (pp. 56–66); Tea Pests in Dutch East Indies and Their Control: The Tachinid *Chaetoxorista javana* B. & B. as an Efficient Parasite of the Limacodid Caterpillar *Setora (Miresa) nitens* Wlk., by R. Menzel (pp. 67–74); A Test of the Influence of Time of Sowing, Size of Grain, Stand, and Tillage on the Attack of Four Varieties of Oats by *Oscinis frit*, by R. Kleine (pp. 75–98); The Polyhedral Disease of the Nonne or Nun Moth and Its Cause, by J. Komárek and V. Breindl (pp. 99–162); The Spreading Power of Liquid Sprays and Its Measurability by a New Method (pp. 163–176), The Woolly Aphid and Its Host Plants (pp. 177–180), and *Tinea cloacella* Hw. and *Tinea granella* L. (pp. 181–188), all by F. Stellwaag; Spraying and Dusting with Arsenicals for the Control of the Codling Moth, by W. Speyer (pp. 189–210); and Notes on Plant Pathology in Holland, by L. Reh (pp. 211–216).

Among other short contributions are the following: On the Outbreak of Tipulids in Nun Moth Areas (pp. 217, 218) and *Hedobia pubescens* F., an Enemy of Loranthaceae (pp. 218–220), both by M. Dingler; Economic Entomology in Russia, by K. Escherich (pp. 220, 221); Nematodes and *Hylobius abietis* (pp. 225, 226); A Contribution to the Control of the Woolly Aphid, by H. W. Frickhinger (pp. 228, 229); A New Effective Insecticide for the Clothes Moth (Hexachlorethane C₂Cl₆), by M. Dingler (p. 231).

The insect fauna of Quelpart Island (Saishiu-to), H. OKAMOTO (*Chosen Govt. Gen. Agr. Expt. Sta. Bul.*, 1 (1924), No. 2, pp. [2]+IV+47–233, pls. 5).—This paper deals with a general survey of the insect fauna of Saishu (Quelpart) Island and of Chosen (Corea) and Japan, with those of adjacent and other parts of the world, and with their relations to agricultural crops and to human welfare.

Report by the entomologist, Mandalay, for the year ended 30th June, 1923, C. C. GHOSH (*Mandalay Ent. Rpt. 1923*, pp. 27).—This report deals with the occurrence of and work with the more important insects of the year.

Report of work done in the entomological section [Mysore], during the year ending 30th June, 1923, K. KUNHI KANNAN (*Mysore Dept. Agr. Rpt. 1922–23*, pt. 2, pp. 16–20).—Campaigning work against *Amsacta albistriga*, which resulted in the collection of 270,299 moths, is first reported upon, followed by an account of the occurrence of and work with the mango hoppers (*Idiocerus* spp.), control work with the rhinoceros beetle (*Oryctes rhinoceros*), the insecticidal property of metallic mercury, the coffee borer, sugar cane borer, etc.

Annual report of the Government entomologist [of Uganda], H. HARGREAVES (*Uganda Dept. Agr. Ann. Rpt.*, 1923, pp. 15–21).—This report deals with insects of economic importance in Uganda during 1923, particularly those attacking coffee and cotton.

Important foreign insect pests collected on imported nursery stock in 1923, E. R. SASSCER (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 443, 444).—This is an abstract of a paper on the more important interceptions of insects on nursery stock in 1923.

Status of hydrocyanic acid gas treatment of nursery stock, J. J. DAVIS (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 440–443).—The author summarizes the complaints from both nurserymen and orchardmen relative to the injury to

nursery trees when fumigated with hydrocyanic acid gas and the factors involved. The need of further experiments with the gas and additional materials and probable plans for such investigations are suggested.

Effect of fumigation upon heating of grain caused by insects, E. A. BACK and R. T. COTTON (*Jour. Agr. Research* [U. S.], 28 (1924), No. 11, pp. 1103-1116, figs. 2).—In reviewing the literature on the subject, the authors point out that, while wheat with a moisture content of less than 14.5 per cent will remain in condition if given proper storage and kept free of insects, it may heat when the moisture content is as low as 12 per cent if insects are present. A study by the U. S. D. A. Bureau of Markets led to the conclusion that heating due to insect infestation occurred when the moisture content was as low as 11.3 to 12 per cent. The authors have known chick-peas in 240-lb. sacks to heat as a result of attack by *Bruchus quadrimaculatus*, the temperature rising as high as 103° F. when the normal temperature was 58°. Such heating has quite generally been thought to be due to fermentation started by the attraction of moisture to the feces of the insects. Others have considered it due to mechanical friction caused by the insects' feeding.

In the authors' investigations, the details of which are presented in tabular form, it was found that fumigation with either hydrocyanic acid gas or carbon disulfide of grain that had heated as a result of insect infestation brings about a fall in the temperature of the grain to normal. This has led the authors to conclude that, barring the possibility that bacteria, molds, or other agencies causing heat are killed by the fumigation with these insecticides, the activity of certain stored-product pests is directly responsible for the development of the heat in the grain. A list is given of 16 references to the literature cited.

New insecticides for the Mexican bean beetle and other insects, S. MARCOVITCH (*Tennessee Sta. Bul.* 131 (1924), pp. 19, figs. 8).—Experiments conducted by the author have shown that many of the fluorine compounds are effective in destroying the adult Mexican bean beetles. Sodium fluosilicate, calcium fluosilicate, and cryolite have considerable insecticidal value when mixed with hydrated lime in the proper proportions. Sodium fluosilicate is a contact as well as a stomach poison. Due to its irritating effect, the beetle attempts to clean its feet in its mouth, and enough of the chemical is thus ingested to cause death. It is pointed out that sodium fluosilicate is cheaper than arsenicals, has the advantage of acting as a contact as well as a stomach poison, kills more rapidly, is less poisonous to people, and is effective against a variety of insects, such as chicken lice, roaches, tobacco hornworms, flea-beetles, and potato beetles. The density of sodium fluosilicate as obtained in the market is high, but work is being carried out with a view to remedying this defect. Cotton boll weevils were killed with sodium fluosilicate without lime in from 4 to 30 hours.

In experimental work, gases absorbed on charcoal gave good results as insecticides. Charcoal containing 0.01 per cent mustard gas with a little ether was dusted on plant, and bean beetles were killed in from 3 to 12 hours. Nitrobenzene on charcoal was also effective in destroying the beetles. These gasses killed boll weevils in from 6 hours to 5 days. When used as a dust, sodium fluosilicate mixed with nine parts by volume of hydrated lime gave excellent control against the Mexican bean beetle. When thus mixed, and properly used, sodium fluosilicate showed a net return as high as \$187.60 per acre at a time of the season when bean beetles were very abundant.

Promising plant insecticides, S. MARCOVITCH (*Science*, 61 (1925), No. 1566, p. 22).—This article deals with the work presented in the account above noted.

The minor pests of sugar-cane in Fiji, R. VEITCH (*Colon. Sugar Refining Co. [Sydney] Agr. Rpt. 7 (1923), pp. 30, pls. 7*).—This report deals with 17 pests of minor importance as enemies of sugar cane.

Biological control of prickly-pear in Australia: Contributing efforts in North America, J. C. HAMLIN (*Jour. Econ. Ent., 17 (1924), No. 4, pp. 447-460, pls. 2*).—An account by the officer in charge of the prickly pear investigations of the Australian Government.

Observations on the clear-winged grasshopper (*Camnula pellucida* Scudder), J. R. PARKER (*Minnesota Sta. Bul. 214 (1924), pp. 5-44, figs. 6*).—This is an account of a widely distributed species which in Minnesota is largely confined to the northern half of the State, it being the grasshopper found most commonly in the Iron Range counties. The studies conducted included experiments with poison bran mash, investigations of the response to meteorological factors, and observations on its seasonal history and habits, the details being presented in large part in tabular and chart form.

Amyl acetate was found to be the most effective of several materials used as attractants in grasshopper baits, surpassing butyl and propyl acetate, lemons, and synthetic apple flavoring. All of the attractants except lemons gave better results when used in combination with molasses. It was found that salt not only added to the effectiveness of all attractants with which it was combined, but in some tests ranked very high when used alone. It is concluded that grasshopper baits for use in Minnesota should contain amyl acetate, molasses, and salt, in addition to the basic ingredients, bran, arsenic, and water.

The activities of *C. pellucida* are to a large extent controlled by temperature. The range of normal activity extends from approximately 68 to 104° F. Little movement is seen at air temperatures below 60° F., and several hours' exposure at 40° F. renders it completely dormant. Fatal temperatures for a 12-hour exposure are reached at 17.6° F. and for 10-minute exposures at 122 to 136° F. (several specimens surviving the latter temperature, however). When given a choice, *C. pellucida* prefers to rest on surfaces whose temperatures approximate 98 to 100° F. The surface of the ground frequently is much warmer than this, but the grasshopper can generally reach a temperature it prefers by simply climbing up weeds or grass to 2 in. above the ground, this sometimes making a difference of 39.6° F. Maximum feeding at poisoned bran mash occurs when the air temperature first reaches from 73 to 77° F.

"A comparison of tin pans and boards for containers of poisoned bran mash in conducting grasshopper bait tests showed that the surface of the boards was much warmer than the surface of the pans. This caused the grasshoppers to seek the boards for warmth during the cooler hours of the day and to avoid them during the hottest hours, thus introducing a serious experimental error. Continued high relative humidity is detrimental to *C. pellucida*, as it brings about conditions favorable for the development of grasshopper diseases.

"In Minnesota *C. pellucida* nymphs did not migrate, and no congregating of the adults in definite areas for egg laying was witnessed. This is in marked contrast to the habits of the same species in Montana and Utah, where migrations of the young nearly always take place, and the adults gather over a considerable area in a few places for mating and egg laying."

A preliminary report on the parasitic enemies of the citricola scale [*Coccus pseudomagnoliarum* (Kuwana)], with descriptions of two new chalcicoid parasites, H. COMPERE (*Bul. South. Calif. Acad. Sci., 23 (1924), No. 4, pp. 113-123, figs. 6*).—It is first pointed out that the so-called citricola scale has been found by Clausen (*E. S. R., 49, p. 355*) to be synonymous with *C. pseudomagnoliarum*. The scale is said to be preyed upon by at least four

species of primary parasites, which are the same species that attack the soft brown scale. While the latter is held in check almost entirely by these parasites, they lack effectiveness against the citricola scale, but, in the author's opinion, to the fact that it has but one generation, whereas the soft brown scale has several. The parasites mentioned are *Aphycus luteolus* Timb., *Coccophagus lecanii* (Fitch), *C. lunulatus* How., and *Microterys flavus* (How.). Shipments of parasitized citricola scale material by Clausen in Japan have resulted in the rearing of four primary parasites, namely, *Anicetus annulatus* Timb., *C. yoshidae* Nak., *Aphycus orientalis* n. sp., found in the débris of the shipping boxes, and *C. japonicus* n. sp., described from 25 females reared from the citricola scale and from specimens found dead in the débris of shipping boxes.

Parasitism of scales—San José and oyster shell, E. H. SIEGLER and H. BAKER (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 497-499).—In determining the species of parasites present, infested twigs were collected from several regions and the following parasites reared: From San José scale, *Prospaltella perniciosi* Tow., *Aphelinus fuscipennis* How., *A. mytilaspidis* LeB., *Signiphora pulchra* Gir., *Perissopterus* sp., and *Ablerus clisiocampae* Ashm., and from oyster shell scale, *A. mytilaspidis*.

The green peach aphid and its control, W. B. GURNEY and W. LE G. BRERETON (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 9, pp. 667, 668).—This is an account of *Myzus persicae* Sulz., which appeared in the Glen Innes district of New South Wales in 1910, being troublesome then and at intervals during succeeding years. It has also appeared in various districts where peaches are grown, including the Murrumbidgee irrigation area.

The fight against the gipsy moth in New Jersey, T. J. HEADLEE (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 438-440).—This is a summary of the eradication work conducted against the gipsy moth in New Jersey, where the 500 square miles of the original area of infestation has now been reduced to about 250 square miles.

Results of the fourth year's work against the gipsy moth in New Jersey, H. B. WEISS ET AL. (*N. J. Dept. Agr. Circ.* 79 (1924), pp. 13, figs. 8).—This circular summarizes the results of gipsy moth work conducted in New Jersey during the fiscal year ended June 30, 1924 (E. S. R., 50, p. 257). Many of the data are presented in tabular and chart form.

The larval stages and biology of the commoner species of Australian mosquitoes, with the biology of *Aedes pecuniosus* Edwards, L. E. COOLING (*Aust. Dept. Health, Serv. Pub. (Trop. Div.)* No. 8 (1924), pp. 40, figs. 16).—In this contribution the author deals with 11 forms of mosquitoes occurring in Australia.

A synonymic list of the more important species of Culicidae of the Australian region, L. E. COOLING (*Aust. Dept. Health, Serv. Pub. (Trop. Div.)* No. 2 (1924), pp. 61).—This synonymic list includes a 21-page index of the genera and species.

Malaria, with especial reference to Australia and its dependencies, R. W. CILENTO (*Aust. Dept. Health, Serv. Pub. (Trop. Div.)* No. 3 [1923], pp. 141, figs. 35).—This is a review of the status of knowledge of the disease, its transmission by mosquitoes, and means for control. In an appendix (pp. 97-141), Anopheline Mosquitoes of North Australia and the Tropical Dependencies of Australia are dealt with by L. E. Cooling.

The importance of the flaxseed count in predicting the actual fly-free date, C. J. DRAKE, F. A. FENTON, and F. D. BUTCHER (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 480-486, figs. 3).—Through the daily collection of flaxseeds

and the dissection of the viable flaxseeds to determine the percentage of larvae, of pupae, and of parasitized larvae of the Hessian fly, the daily rate of transformation from the larva to the pupa and to the adult state, as well as the rate of approach of the fly-free date, was obtained.

"When this count yields very few pupae and only a small percentage of larvae in contrast to a large number of empty flaxseeds, it is proof that the actual fly-free date is at hand, and that the few remaining pupae will immediately issue as flies, lay their eggs, and perish before wheat drilled at this time will come up. Thus it is possible to predict the fly-free date so that farmers can begin drilling wheat six or seven days before the end of the egg-laying period of the fall brood of flies. The records of the Iowa observation stations for 1922 and 1923 are given in the form of a summary."

Rearing flies for experimental purposes, with biological notes, R. W. GLASER (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 486-496, pls. 2).—During the course of studies of the transmission of microorganisms by insects, in which the house fly, stable fly, and horn fly were used, simple, inexpensive, and effective methods were developed for the rearing and handling of large numbers of flies. Special emphasis is placed on a type of breeding jar, on adult fly foods, on temperature, and on humidity.

A bacterial disease of adult house flies, R. W. GLASER (*Amer. Jour. Hyg.*, 4 (1924), No. 5, pp. 411-415, pl. 1).—In this contribution from the department of animal pathology of The Rockefeller Institute for Medical Research, at Princeton, N. J., the author describes a bacterial disease of adult house flies, the first thus far recorded. This disease is sporadic in its appearance and never assumes the form of an epidemic. About 50 per cent of the adult flies contract the disease when experimentally infected, the males being more susceptible than the females. A *Staphylococcus*, for which the name *S. muscae* is suggested, is found to be the inciting cause. Experimentally infected flies die in from 7 to 29 days, with a mean of 16+ days. The symptoms appear in from 2 to 5 days prior to death. The author presents his reasons for the assumption that but little may be expected from the disease from an economic standpoint.

Plantain root beetle borer, N. K. JARDINE (*Trop. Agr. [Ceylon]*, 62 (1924), No. 6, p. 372, pl. 1).—This is a brief summary of information on the banana root borer.

Dusting and spraying to control grape root-worm, F. Z. HARTZELL (*New York State Sta. Bul.* 519 (1924), pp. 3-29, pls. 2, figs. 2).—Experiments conducted by the author in 1921 and 1922 have failed to discover a dust that will control the grape rootworm or powdery mildew. Dusts made after Sanders' formula, composed of finely powdered monohydrated copper sulfate, hydrated lime, and calcium arsenate, do not have the physical characters to make them adhere to Concord grape foliage, with the result that wind and rain remove so much of the material that little gain in secured in rootworm control, and powdery mildew is not checked.

"The addition of nicotine to Sanders' dust does not increase its toxicity for the rootworm. Nurexo, while giving better control of rootworm than dust, was much less effective than Bordeaux and lead. However, it did check powdery mildew. Homemade Bordeaux mixture with arsenate of lead proved superior to dusts in every test both as regards the suppression of the rootworm and the control of powdery mildew. Sanders' dust, including the expense of application, costs slightly more per application than Bordeaux, lead, and soap. Dusting is about two and one-fourth times as rapid as spraying under vineyard conditions obtaining in Chautauqua County. As regards time-

liness of application, spraying has considerable advantage over dusting, owing to the wind velocities common to the Lake Erie Valley during the season when remedial measures are necessary."

It is strongly recommended that grape growers use homemade Bordeaux mixture (8-8-100) with either 3 lbs. of dry or 6 lbs. of paste arsenate of lead for the control of the grape rootworm and powdery mildew. The addition of 3 lbs. of resin fish oil soap to each 100 gal. of the mixture is advisable, since the cost is small and the increased spreading qualities add to the effectiveness of the spray.

The effect of deficiency and excess in rainfall upon the hickory bark beetle (*Eccoptogaster quadrispinosus* Say), M. W. BLACKMAN (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 460-470, fig. 1).—This is a report of investigations conducted during the course of an outbreak of *E. quadrispinosus* in Syracuse, N. Y., which started in 1912. The author has found that, when the adults are active, continued rain kills many while feeding and establishing their burrows and also checks egg laying. Excess rainfall, humidity, and cloudiness kill the larvae because these conditions produce an excess of water in the plant tissues, and this is set free into the larval mines. Deficiency in rainfall has a beneficial effect upon both adults and larvae, and this may be put to practical use. If it is known that there has been a deficiency in rainfall extending over several years, an intelligent lookout can be made for the first signs of undue increase of dangerous forms, and these can be controlled before they reach epidemic proportions.

Egg and first-stage larva of *Tarsostenus univittatus* (Rossi), a beetle predacious on powder-post beetles, R. A. ST. GEORGE (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 1, pp. 49-51, fig. 1).—This paper deals with a clerid beetle which is of considerable economic importance because of its predacious habits, both in the larval and adult stages. The eggs, which are placed in or near the entrance galleries of their host, hatch in about 10 days. Under normal conditions, the beetles pass the winter in the larval stage, although a few may pupate before early spring.

The sweet potato weevil (*Cylas formicarius* (F.), var. *elegantulus* Summ.), C. C. GOWDY (*Jamaica Dept. Agr., Ent. Circ.* 11 (1924), pp. 5).—This is a summary of information on the weevil in Jamaica.

Results secured from late season applications of calcium arsenate dust for the control of the cotton boll weevil, C. B. NICKELS (*Jour. Econ. Ent.*, 17 (1924), No. 4, pp. 477-480).—This is a report of experiments conducted in the Piedmont section of South Carolina during 1923. Serious injury by the boll weevil did not occur in the majority of fields until August 10 or later, damage by the pest being to late fruiting crops two weeks before migration or after the beginning of migration. The average increase in yield of seed cotton resulting from the use of calcium arsenate dust on comparable plats was 236 lbs. per acre. The average expense of using the calcium arsenate dust method was the cost of 29.27 lbs. of calcium arsenate and 3.6 hours of labor.

Cotton boll weevil situation in Arizona, M. E. BEMIS (*Calif. Cult.*, 63 (1924), No. 14, p. 336).—This is a statement of the present status of control work with the cotton boll weevil from *Thurberia* in Arizona.

[Boll weevil investigations] (*South Carolina Sta. Rpt.* 1924, pp. 6-15, 79, 80, figs. 3).—Following a brief discussion of the boll weevil problem, direct methods of weevil control are considered under the headings of biological and life history work at Florence, field tests with poisons, and laboratory and field studies with poisons at Clemson. A discussion of indirect methods of weevil control is included.

In hibernation work during the winter of 1923-24, 0.02 per cent of 21,617 weevils placed in hibernation on September 8 emerged. Of weevils placed in hibernation between October 1 and 15 0.19 per cent survived, between October 16 and 31 59 per cent survived, and between November 1 and 13 2.45 per cent survived. These data are considered to emphasize the importance of stalk destruction.

In work conducted cooperatively with the U. S. D. A. Bureau of Entomology, F. A. Fenton found that there was a maximum of four generations and a minimum of one generation at Florence during the season of 1924. The overwintered weevils laid a larger number of eggs than in any of the succeeding generations, and some of these overwintered weevils remained alive in the field until August. During the middle of the summer the life cycle was completed in about 28 days. So few weevils emerged from hibernation in the spring that emergence dates are not conclusive, although they show that in 1924 emergence was practically completed by the middle of June, and overwintered weevils commenced to oviposit about the same time. The late summer migration began on August 24, and large numbers were in flight on August 26 and 27, at which time cotton in the vicinity of Florence was beginning to open and square shedding was quite general on account of the dry weather. Punctured squares collected showed the weevil to be attacked by three important species of parasites and two less common species were also reared.

E. D. Kyzer succeeded in keeping the boll weevil completely under control until several weeks after general migration had begun through applying calcium arsenate dust as soon as infestation reached approximately 10 per cent. As a result of the control measures instituted at the station, some of the best varieties in the experimental plats produced more than 2,000 lbs. of seed cotton per acre.

The apple blossom weevil, H. W. MILES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt., 1923, pp. 58-61, pls. 3*).—This is a more complete account of *Anthonomus pomorum* L. than that previously noted (E. S. R., 50, p. 560). Control measures recommended include scraping the trunks of old orchard trees in February and applying an emulsion consisting of potash soft soap 0.5 per cent, paraffin 10 per cent, and soft water 89.5 per cent; spraying with lime sulfur 1-20 in the delayed dormant stage; banding from the middle of March to the end of April; collection of capped blossoms during the first fortnight of May; and banding from mid-June onward.

The solubility of arsenate of lead in the digestive fluids of the honey bee (*Apis mellifica*), H. M. TIETZ (*Jour. Econ. Ent., 17 (1924), No. 4, pp. 471-477*).—Using the honeybee as the insect and the solubility of arsenate of lead powder in water as the unit of solubility, the author has drawn the following conclusions:

"(1) The solubility of arsenate of lead does not seem to increase when the powder is acted upon by the fluids in the esophagus. (2) The digestive secretions of the honey stomach and the stomach render the poison at least one and one-quarter times as soluble. (3) The action of the intestinal juices is to throw at least three and three-quarters times as much of the powder in solution as would be dissolved by water alone."

Morphology of the honeybee larva, J. A. NELSON (*Jour. Agr. Research [U. S.], 28 (1924), No. 12, pp. 1167-1214, pls. 8, figs. 5*).—This detailed account of studies of the morphology of the bee larva is in continuation of the author's studies of the development of the egg, previously noted (E. S. R., 34, p. 362). A list of 55 references to the literature cited is included.

Attacks of *Vespa communis* De Saussure on *Hypantria cunea* Drury, M. T. SMULYAN (*Psyche, 31 (1924), No. 3-4, pp. 138, 139*).—The author reports

attacks of the fall webworm by *V. communis*, which were observed at Roycefield, N. J., in September, 1923. The wasps appeared in large numbers and persistently attacked caterpillars which had been collected for parasite study. They apparently made no attempt to carry off the caterpillars, merely piercing the integument with their mandibles and consuming the liquid and softer parts.

Biological observations on Hemiteles areator Grav. [trans. title], J. C. FAURE (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 37, pp. 1301, 1302).—The author here describes a new mode of suction observed in the suction of its host by *H. areator*, a parasite of *Apanteles glomeratus*.

On the variability of the life cycle of a new ichneumonid parasite of the larvæ of *Neurotoma nemoralis* [trans. title], A. PAILLOT (*Compt. Rend. Soc. Biol. [Paris]*, 89 (1923), No. 33, pp. 1045-1048).—The author reports upon the parasitism of *N. nemoralis*, which has invaded peach orchards in the valley of the Rhone, by *Limnerium crassifemur*, a parasite of microlepidopterous larvae, including *Pyrausta nubilalis*. It is pointed out that the change of host is accompanied by an important modification of the life cycle of the parasite.

Eggs of *Ascaris lumbricoides* and low temperatures [trans. title], C. R. BAKKER (*Tijdschr. Vergelijk. Geneesk.*, 10 (1924), No. 4, pp. 275-281).—Exposure of eggs of *A. lumbricoides* to a temperature of -15° (5° F.) had no influence upon their development, but none of the eggs could resist a temperature of -30° or lower.

FOODS—HUMAN NUTRITION

Absorption and retention of hydrocyanic acid by fumigated food products, Part II, E. L. GRIFFIN and E. A. BACK (*U. S. Dept. Agr. Bul.* 1307 (1924), pp. 8).—The investigation previously noted (*E. S. R.*, 49, p. 456) has been extended to dried fruits, candy and candy-making materials, cereals, meat, cheese, and dried milk. The fumigation with hydrocyanic acid was carried out by the pot method, using 1 oz. of sodium cyanide for each 100 cu. ft. of space and a time of exposure of about 18 hours. All of the products tested were fumigated without any protection from the gas, and also in the containers in which they were purchased—cloth sacks, wrapped cartons, tin foil, etc. The content of hydrocyanic acid in the products was determined by the method outlined in the previous publication on the day of fumigation and after storage at about 40 and 70° F. for periods of 1, 7, 30, and 90 days.

All of the dried fruits left unwrapped absorbed hydrocyanic acid. The penetration into the wrapped samples depended upon the nature of the wrapper. Newspaper and pasteboard afforded little protection and waxed paper almost complete protection. Most of the fruits which had absorbed hydrocyanic acid retained some of it even at the end of 3 months' storage. More was retained in cold storage than at room temperature. Dried black raspberries absorbed and retained more hydrocyanic acid than any of the other fruits.

Of the candies and candy-making materials, cocoa absorbed and retained the largest amount. Candies absorbed very little. Nut meats absorbed a large proportion of hydrocyanic acid and gave up most of it very readily, but the remaining amount, about 11 parts per million, was held very firmly.

The cereals absorbed considerable hydrocyanic acid, but gave it up readily. This was also true of meat, dried milk, and of soft, loosely wrapped cheese. The hard rind of American Swiss cheese furnished sufficient protection against absorption of the gas.

Attempts to remove the hydrocyanic acid from some of the products by boiling with water for 30 minutes were not entirely successful.

Supplemental data from the literature on the subject are reviewed and discussed.

Methods of educating the public to the value of milk (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 661-694*).—Papers presented at the congress under this general subject are as follows: Per Capita Milk Consumption from the Point of View of the Public Health Officer, by H. Emerson; Welfare Agencies as a Factor in Educating Consumers in the Use of Milk, by L. H. Gillett; The Work of the Canadian Department of Agriculture in Increasing the Consumption of Milk, by H. G. Campbell; The Health Demonstration and Nutrition, by W. H. Brown; Community Milk-for-health Campaigns as Conducted by the United States Department of Agriculture, by J. M. Hoover; and The Work of the Dairy Council, by M. D. Munn.

Milk in the diet (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 837-850*).—The program on this general subject at the World's Dairy Congress consisted of papers on Nutrition Work in Labrador, by M. R. Moseley, and Milk and Health, by C. Hedger.

Milk in relation to child life and health, B. DAVIES (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 555-562*).—This paper is essentially a plea, supported by data on infant mortality in England and Wales, for rigid laws concerning the bottling of milk. The beneficial effects of pasteurization are shown to be counteracted if the milk is not protected from contamination until used. The advantages in this respect of the use of dried milk are emphasized.

[Nutrition activities in the public schools] (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 114-128, 130-133*).—Included in the program of National Dairy Council day were the following papers: Health of Our School Children, by S. L. Jean; The Philadelphia Public Schools, by E. C. Broome; Demonstration of School Work, by L. Conwell; and Results of Dairy Council Work, by W. A. Wentworth.

The use of evaporated, condensed, and dried milk in the dietary (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 149-206, figs. 10*).—This symposium consisted of the following papers, the subject matter of some of which has been noted from other sources: The Use of Sweetened Condensed, Evaporated, and Powdered Milks for Feeding Infants in the Tropics, by W. E. Deeks (*E. S. R.*, 51, p. 556); Observations on Milk Supply under Tropical and Subtropical Conditions, by C. P. Sherwin; Variations of the Vitamin A Content of Cow's Milk under Different Conditions of Feeding, by J. Golding (*E. S. R.*, 49, p. 780); The Use of Milk in Bread, by R. M. Allen; The Use of Milk Powder in Baking, by C. A. Glabau; The Development of Dried Milk as a Food, by R. J. Blackham; and Vitamins in Preserved Milks, by C. Kennedy.

The nutritional value of milk (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 421-464, figs. 13*).—This symposium includes six papers.

The nutritional value of milk, E. V. McCollum, H. T. Parsons, and E. Kalmbach (pp. 421-437).—A general report, with selected data, is given of a demonstration on an extensive scale of the value of milk as a supplement to a qualitatively insufficient diet. In an institution containing 236 negro children all in a condition of malnutrition, 84 were selected for the investigation, which continued in the case of most of the children for 21 months. The children were paired as closely as possible according to weight, size, and general condition. All were continued on the institutional diet, which consisted essentially of a soup made from a fairly wide variety of foodstuffs, with bread ad libitum. One of each pair received in addition 1 qt. of milk daily.

Evidence that the diet had been insufficient quantitatively as well as qualitatively and was improved in the latter respect when the investigation was begun was afforded by the rapid gain in weight at first of the children in both groups. After about 6 weeks this ceased with the children receiving simply the institutional diet, but growth continued at more than normal rate with the children receiving milk. Several increased 50 per cent or more in weight during the first year. After 15 months, the children in the control group were also given a quart daily of reconstituted milk and showed the same response in gain of weight. It is stated that the children not receiving milk were apathetic and tractable, while those receiving milk showed greater restlessness and desire for activity.

An interesting point brought out in the study was the lack of scurvy in all children, although the diet before improvement had no fresh foodstuffs. It was found that the institution received regular donations of lemons from nearby fruit vendors and each child had been given a slice of lemon a day.

Milk as a food, L. B. Mendel (pp. 438-444).—This is a general discussion of the value of milk as a food from the standpoint of the quality of its proteins, its content of vitamins and calcium, and the use of milk as a carrier of acidophilic microorganisms (*Bacillus acidophilus*).

The optimum amount of milk for children, H. C. Sherman (pp. 445-447).—This paper consists essentially of a brief review of the study by Sherman and Hawley of calcium and phosphorous metabolism in childhood (E. S. R., 48, p. 463), which showed the optimal amount of milk for growing children to be about 1 qt. a day. From the long-continued investigation which is being conducted in the author's laboratory of the effect through successive generations of limited and ample amounts of milk, a further recommendation is made as follows:

"In view of such evidence, it seems a mistake to limit the recommendation of a quart of milk per day to the ages from infancy to puberty. Undoubtedly it would better be extended, probably to all ages. Certainly it seems to me the boy should have his quart of milk per day until he is a man full grown, and the girl should continue to take her quart of milk per day until as a woman she has weaned her last child."

Blindness and other diseases in children arising in consequence of deficient nutrition (lack of fat-soluble A factor), C. E. Bloch (pp. 447-456).—Previously noted from another source (E. S. R., 51, p. 267).

Milk in the Tropics, R. J. Blackham (pp. 456-463).—Essentially noted from another source (E. S. R., 46, p. 879).

Milk as a standard of nutrition, C. Pirquet (pp. 463, 464).—A brief summary of the essential features of the author's nem system (E. S. R., 48, p. 462).

The calcium metabolism of atrophic infants and its relationship to their fat metabolism, E. M. HICKMANS (*Biochem. Jour.*, 18 (1924), No. 5, pp. 925-936, figs. 7).—Data are reported on the calcium and fat metabolism of 48 atrophic infants during 5-day periods on specified diets, preceded by 3 days on the same diets which included humanized, dried, condensed, and skim milk. In addition to the tabulated data, the results obtained are presented graphically to show for the same diets the relationship between the weight of dried feces and its content of calcium oxide, the intake and output of calcium oxide on the various diets, the weight of calcium oxide absorbed and the fat intake, and the weight of fat and calcium oxide absorbed and excreted.

The average absorption of calcium oxide for the 48 cases was 43 per cent, the amount varying with the different diets and with the proportion of fat to calcium. The best absorption took place when the amount of

calcium oxide was from 0.04 to 0.078 gm. for 1 gm. of fat in the milk and water mixture. With one sample of dried milk the absorption was good when calcium oxide ran as high as 0.12 gm., while a dried humanized milk powder gave a very low value.

The actual weight of calcium oxide absorbed varied from 0 to 1.7 gm., with an average of 0.43 gm. in 24 hours. The amount absorbed per kilogram of body weight varied from 0 to 0.33 gm., with an average of 0.12 gm. It is considered that to insure an absorption of 0.1 gm. of calcium oxide per kilogram of body weight the fat must be between 2 and 6 gm. per kilogram.

Fasting and undernutrition, S. MORGULIS (*New York: E. P. Dutton & Co. 1923, pp. XIII+407, pls. 6, figs. 9*).—In this volume on the biological and sociological aspects of inanition, physiological inanition as illustrated by hibernation is first discussed from its chemical, physiological, and morphological phenomena. Experimental inanition is then considered under the same groupings, with additional chapters on partial, chronic, and intermittent inanition. A final section deals with inanition and growth.

An extensive bibliography classified according to the topics discussed is appended.

On the existence of a hitherto unknown dietary factor essential for reproduction, H. M. EVANS (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1027-1034*).—Essentially noted from another source (*E. S. R., 51, p. 167*).

Investigation of barley, malt, and beer for vitamins B and C, A. HARDEN and S. S. ZILVA (*Biochem. Jour., 18 (1924), No. 5, pp. 1129-1132*).—The authors have reinvestigated the antineuritic and antiscorbutic properties of barley, malt, and beer, using for the tests for vitamin B both pigeons and rats and for vitamin C guinea pigs and monkeys.

Pigeons fed on steeped grain, grain germinated for 5 days, and the germinated grain just before kilning gained in weight and were protected from polyneuritis, while pigeons fed on barley or malt did not gain in weight but were protected from polyneuritis. In the rat experiments, growth resulted when either barley or malt constituted from 10 to 50 per cent of a diet otherwise lacking in vitamin B. The evaporated extract of beer in amounts constituting from 5 to 25 per cent of the ration was without effect.

In the guinea pig experiments barley and malt were inactive as a source of vitamin C, but the steeped grain, the grain germinated for 5 days, and the germinated grain just before kilning were all active when fed ad libitum. Beers were tested for vitamin C on monkeys and were found to be inactive.

The fate of bakers' yeast in the intestine of man and of the white rat, L. F. RETTGER, G. F. REDDISH, and J. G. McALPINE (*Jour. Bact., 9 (1924), No. 4, pp. 327-337*).—In this investigation the fate of bakers' yeast in the intestinal tract of rats and human subjects was studied from the point of view of the viability of the yeast and possible changes in the intestinal bacteria brought about by its presence. In addition, the effect was studied of the introduction of yeast into mice, guinea pigs, and rabbits by subcutaneous, intravenous, and intraperitoneal injections. The rats were fed ground dog biscuit mixed up with melted butter to a smooth paste, and the human subjects ate their customary diet. The rats received from 0.2 to 3 gm. of yeast daily and the human subjects from 14 to 42 gm., or from 1 to 3 yeast cakes daily.

During the yeast feeding, viable cells were excreted, but in small numbers compared with the amount ingested. It is estimated that less than 1 per cent of the cells escape destruction within 24 hours. After the discontinuance of the yeast feeding both dead and living cells disappeared very rapidly.

The injection of bakers' yeast into mice, guinea pigs, and rabbits caused no injury nor was the temperature of the animals affected. The weight of the animals remained stationary or increased slightly during the period of observation following the injection.

Newer clinical signs of early rickets, C. U. MOORE (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 19, pp. 1469-1473, figs. 8).—This and the four papers which follow constitute a symposium on rickets held at the annual meeting of the American Medical Association in Chicago, June, 1924.

In this paper the author discusses the more important skeletal signs of rickets, pointing out that rickets develops during the period of the most rapid growth of the portion of the body affected and consequently that during the first four months of life craniotabes or cranial rickets most frequently occurs, accompanied or followed by disturbances in the thorax indicated by rachitic changes in the chest and still later by rickets of the extremities. Descriptions are given of the evidence of these three forms of rickets.

The underlying cause in the pathogenesis of rickets, L. FINDLAY (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 19, pp. 1473-1479, figs. 3).—In this discussion, which is based largely on the extensive investigations of the author and co-workers at the University of Glasgow, the conclusion is drawn that a diminished absorption of calcium from the intestines is the chief etiological factor in rickets. As to the cause of the diminished absorption, the possibility is suggested of a specific infection influencing the reaction of the intestinal contents in such a way as to render the calcium less soluble and less easily absorbed. In confirmation of this hypothesis, experiments are cited showing that in health all of the calcium of a given diet is rendered soluble within two hours, while in rickets only about 90 per cent becomes soluble during the same period.

The organization of a special clinic for the treatment of rickets with the mercury vapor quartz lamp in an outpatient department, E. T. WYMAN and C. A. WEYMULLER (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 19, pp. 1479-1483, figs. 4).—At a special outpatient clinic in the Children's Hospital, Boston, 86 cases of acute rickets have been cured by ultraviolet radiation three times a week for a period of from 6 to 8 weeks. Six normal babies which received the same treatment showed no evidence of rickets and an improvement in general condition, while 6 others receiving both light and cod liver oil treatment showed even more marked improvement. In the experience of the authors, ultraviolet rays bring about a more complete cure of rickets than any other therapeutic agent alone.

Rickets as influenced by the diet of the mother during pregnancy and lactation, A. F. HESS and M. WEINSTOCK (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 20, pp. 1558-1562).—The authors discuss the question of hereditary and congenital factors in rickets, and report studies on the influence of the diet of the mother on the subsequent development of rickets in her offspring.

The conclusion reported in a previous paper (E. S. R., 51, p. 267) that cod liver oil fed during pregnancy and lactation is incapable of preventing rickets in young rats after they have been placed upon ricket-producing diets has apparently been confirmed in the case of human subjects. Of 28 women who took 16 oz. or more of cod liver oil during the last 2 months of pregnancy, 15 had babies which developed rickets while being nursed.

A further series of experiments was carried out on female rats, the scheme being to feed an inadequate diet supplemented with antirachitic substances during one or more of the prepregnant, pregnant, and nursing periods and to note the presence or absence of rickets in the young, as well as their growth. The results obtained showed that it is not possible to prevent rickets by improving the diet of the mother during any or all of these periods.

"It must not, however, be assumed that the contrary holds true and that resistance can not be broken down by this means. It may be stated as a principle that resistance to rickets can be lessened by means of inadequacy of a mother's diet far more readily than a refractory condition can be brought about. The distinction between these two points of view should not be lost sight of in considering the relation of diet to rickets either in animals or in man. The fact that susceptibility to rickets may be induced by an inadequacy of the maternal diet does not warrant the conclusion which has at times been drawn that it is likewise possible to render the young resistant by fortifying nutrition during the prenatal period."

Correlation of clinical, roentgenologic, and serologic evidences of rickets in breast-fed. L. R. DEBUYS and L. VON MEYSENBURG (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 20, pp. 1563, 1564).—A study of various clinical signs of infantile rickets is reported with the conclusion that serologic examination, while not always of practical application, is the most reliable method of determining the activity of the disease. Positive X-ray evidence is thought to be of decided value, and epiphyseal enlargement and costal beading the most dependable of the clinical symptoms.

Further studies on the nervous paralysis of the polished rice disease. G. KATO (*Japan Med. World*, 4 (1924), No. 9, pp. 233-237).—This paper reports further studies carried on by the various workers in the author's laboratory on the relation of H-ion concentration to the nerve paralysis in avian polyneuritis (*E. S. R.*, 46, p. 669).

Determinations by means of the subcutaneous electrode of the H-ion concentration of tissue fluids directly surrounding the sciatic nerve in fowls showed that in normal and in starved fowls the reaction is nearly neutral, but that in polyneuritic fowls the H-ion concentration is greatly increased. When rice bran extract is injected into the pectoral muscles or fed, the fluid is reduced to normal H-ion concentration and the nerves show recovery. It was also demonstrated that the rice bran extract acts directly upon the nerves of polyneuritic but not of normal fowls. Heated extracts no longer containing vitamin B have a similar action, although much slower and within definite limits of H-ion concentration (neutral or slightly alkaline).

It is concluded that the curative effect of heated extracts is due to the decrease in H-ion concentration of the nerves as the result of the alkalinity of the solution, while the curative effect of extracts of vitamin B is due to a special property of vitamin B of decreasing negative charges in paralyzed nerves.

The relationship of phosphates to carbohydrate metabolism.—I, Time relationship of the changes in phosphate excretion caused by insulin and sugar. S. S. SOKHEY and F. N. ALLAN (*Biochem. Jour.*, 18 (1924), No. 5, pp. 1170-1184, figs. 5).—Analyses are reported of the urine of normal and depancreatized dogs for phosphorus, total nitrogen, ammonia, and creatinine before, during, and after insulin hypoglycemia. To eliminate the effect of food, the animals were starved throughout the experiment.

The administration of insulin to the normal animals was followed immediately by a reduction in the excretion of organic phosphate in the urine, sometimes to a point at which it became too small to measure. After about 6 hours there was an increase in the phosphate excreted, often bringing the total amount excreted to from 25 to 35 per cent above the normal for the day. The nitrogen excretion was increased to an average of about 20 per cent above normal and occasionally to double the normal amount. The excretion of ammonia and the titratable acidity of the urine in general followed the same course as the phosphorus. There was no change in creatinine.

The ingestion of sugar by normal fasting animals brought about practically the same changes as did insulin, only more slowly. Insulin and glucose together brought about the same changes as when given separately.

In diabetic dogs the phosphate excretion was more than double the normal. The administration of insulin caused a decrease in the excretion at first, followed by an increase to the level for a normal dog. Clear-cut results were not obtained with sugar.

These experiments are thought to furnish clear evidence of an intimate relationship between the metabolism of carbohydrates and phosphoric acid. The increase in nitrogen excretion after insulin injections is considered due to the breaking down of the process in order to provide for the necessary sugar.

The efficiency of various sugars and their derivatives in relieving the symptoms caused by insulin in mice, P. T. HERRING, J. C. IRVINE, and J. J. R. MACLEOD (*Biochem. Jour.*, 18 (1924), No. 5, pp. 1023-1042).—This paper consists of a report by P. T. Herring of a comparison of the value of various sugars and their derivatives in the treatment of insulin convulsions in mice, a discussion by J. C. Irvine of the results obtained in terms of carbohydrate structure, and comments by J. J. R. Macleod.

Of the unsubstituted sugars, glucose and mannose were the most effective, with maltose next. Fructose was usually effective, but only temporarily. Galactose occasionally gave a temporary but never a permanent effect. Lactose and sucrose were inactive. Of the three substituted reducing sugars tested, tetraacetylfructose in a few instances relieved convulsions temporarily, while tetramethylglucose and trimethylglucose were inactive. Seven glucosidic compounds, two alcohols (mannitol and dulcitol), and one anhydro-sugar, β -glucosan, were inactive.

In the interpretation of these results from the standpoint of structure, it is concluded that for activity the presence of a reducing group and of certain asymmetric systems is essential. The reaction is thought to "take place in definite steps, the first of which involves the reducing group either alone or in conjunction with one other hydroxyl group. The remaining hydroxyl groups then react singly or in pairs according to their stereochemical position." In other words, it is not the sugar as a whole which reacts but definite sections of the molecule."

In the comments by Macleod, attention is called to the fact that the sugars which are most active in relieving hypoglycemic symptoms are those which are directly fermentable by yeasts.

ANIMAL PRODUCTION

Inspection of commercial feeding-stuffs, H. R. KRAYBILL, T. O. SMITH, and J. T. SULLIVAN (*New Hampshire Sta. Bul.* 213 (1924), pp. 63).—This is the usual report of the inspection of feeding stuffs during 1924, consisting mainly of a list of the feeds with their guaranties and analyses and definitions of feeding materials (E. S. R., 51, p. 73).

[Experiments in beef production at the South Carolina Station] (*South Carolina Sta. Rpt.* 1924, pp. 64, 84).—Tests of rations for feeding calves and breeding stock were conducted during the year.

Velvet beans and cottonseed meal for fattening calves.—In continuing the study of the feeding value of velvet beans (E. S. R., 50, p. 672), whole velvet beans and cottonseed meal were compared as protein supplements to a ration of shelled corn, oats, and corn silage for fattening calves. The lot receiving the cottonseed meal made average daily gains of 2.19 lbs. at a calculated feed cost of \$8.90 per 100 lbs. of gain, while the lot receiving velvet beans made

average daily gains of 2.34 lbs., and the calculated feed cost was only \$7.78 per 100 lbs. of gain.

Wintering beef cattle [at the Coast Substation] (pp. 64, 84).—The costs of wintering aged cows, 2-year-old heifers, and yearling heifers from December 19 to March 7 on a ration of cottonseed meal and sorghum silage were determined as follows: \$13.85, \$9.68, and \$7.76, respectively. The average daily gains of the respective lots were 0.16, 0.60, and 0.57 lb.

Effects of winter rations on pasture gains of beef calves and yearlings. E. W. SHEETS and R. H. TUCKWILLER (*West Virginia Sta. Bul.* 186 (1924), pp. 34, figs. 13).—Another account of the experiments previously noted in U. S. Department of Agriculture Bulletins 870 and 1042 (E. S. R., 44, p. 176; 46, p. 765).

Effect of winter rations on subsequent pasture gains of steers, E. W. SHEETS (*Jour. Agr. Research [U. S.]*, 28 (1924), No. 12, pp. 1215-1232, pls. 9, figs. 12).—Another account of the experiments previously noted (E. S. R., 51, p. 772).

Fattening western lambs, 1923-1924, H. D. Fox (*Nebraska Sta. Bul.* 204 (1924), pp. 24).—Two experiments in comparing the feeding and management of fattening lambs were conducted, the first experiment being similar to the one previously noted (E. S. R., 50, p. 574).

Ten lots of 30 lambs each were fed in this test, which lasted 110 days. Lots 1 and 10 received a basal ration of shelled corn and alfalfa hay, the results with the two lots being averaged as lot 1. Changes and additions as follows were made to this ration for the other lots: Lot 2 received a small amount of oats during the first 8 weeks of the experiment; lots 3, 4, and 5 received additional supplements of 0.142, 0.237, and 0.342 lb. of linseed oil meal, respectively, per head daily; lot 6 received prairie hay in place of the alfalfa hay and 0.352 lb. of linseed oil meal per day; and lots 7, 8, and 9 received alfalfa molasses meal in the following average amounts per lamb daily: 0.186, 0.554, and 0.976 lb., respectively.

Six lots of 26 lambs each were fed in the second experiment, which lasted 60 days. Lots 1, 2, and 3 received rations of corn and alfalfa hay, while lots 4, 5, and 6 received, in addition, 0.22 lb. of linseed meal per head daily. The effects of different times of shearing were compared in this test, lots 1 and 4 not being sheared. Lots 2 and 5 were sheared 10 days after being started on feed, while lots 3 and 6 were sheared 2 weeks before marketing. The results of both experiments are summarized in the following table:

Experiments in fattening western lambs

Experiment	Lot	Average initial weight	Average daily gain	Feed consumed per 100 lbs. gain						Calculated profit per head	Dressing percentage
				Corn	Oats	Linseed oil meal	Alfalfa molasses meal	Prairie hay	Alfalfa hay		
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	\$	Per ct.
1	1	63.07	0.258	455					435	\$0.43	48.49
	2	62.93	.251	410	75				408	.33	48.27
	3	63.50	.294	402		48			377	.70	49.04
	4	62.87	.312	373		76			354	.84	50.07
	5	62.67	.328	351		104			318	.78	49.96
	6	62.80	.262	448		135		272		—	48.04
	7	62.97	.275	426			68		360	.64	49.64
	8	63.00	.299	390			185		281	.69	49.60
	9	63.00	.265	426			368		159	.31	49.52
	1	71.69	.517	326					235	3.20	48.64
	2	70.73	.463	355					295	1.60	48.51
	3	70.92	.449	347					257	1.87	50.09
	4	72.31	.546	301		40			224	3.19	48.84
	5	71.42	.551	308		39			237	1.06	50.04
	6	71.96	.528	318		41			215	2.09	52.49

The results showed that the larger amounts of oil meal produced greater gains and kept the lambs in better feeding condition. The alfalfa molasses meal added in small amounts reduced the costs of gain and the amount of alfalfa hay required, but the greatest profits were made with medium amounts of alfalfa meal. No advantage was shown for the oats or prairie hay feeding. As to the different times of shearing, it was found that the late shorn lambs produced from 0.9 to 0.98 lb. more wool of a better quality than early shorn lambs.

The influence of individuality, age, and season upon the weights of fleeces produced by Angora goats under range conditions, J. L. LUSH and J. M. JONES (*Texas Sta. Bul.* 320 (1924), pp. 3-54, figs. 13).—This bulletin reports the results of a study of the weights of the fleeces of Angora goats for two 12-months spring shearings, five 6-months fall shearings, and five 6-months spring shearings. The relations between the successive shearings of the same goats have been grouped according to breeding, age, and sex, and a series of 302 correlation tables have been constructed, the calculated coefficients being tabulated. There was much variability in the different correlations, but the averages showed some tendency toward uniformity in the fleece weights of individuals at succeeding shearings. Shearings at the same season of the year resembled each other more closely than spring and fall shearings. There was also a higher correlation between shearings separated by a shorter time interval than between shearings several years apart.

Angora fleeces are apparently influenced more by environmental conditions than are wool fleeces, as was found in Bulletin 311 (E. S. R., 51, p. 75). Age has a distinct effect on the first three shearings, the maximum fleece production being attained during the second year. Advancing age does not greatly reduce fleece production except in goats over 6 years. It is recommended that mohair producers cull their flocks on the basis of the individual fleece weights.

[Feeding experiments with swine at the South Carolina Station] (*South Carolina Sta. Rpt.* 1924, pp. 61-64, figs. 3).—The results of feeding experiments with swine in continuation of those previously noted (E. S. R., 50, p. 672) are briefly reported.

Soy bean forage for hogs.—In another year's study of the value of soy bean forage for hogs, 25 pigs were divided into two lots, one lot being placed on soy bean pasture with a 2 per cent corn ration for 71 days while the other lot received corn and tankage in dry lot. The average daily gains of the two lots were, respectively, 0.85 and 0.74 lb., the former lot requiring 128.26 lbs. of corn and 0.22 acre of soy bean forage per 100 lbs. of gain. The hogs in dry lot required 333.24 lbs. of corn and 53.71 lbs. of tankage per 100 lbs. of gain.

Following the grazing period both lots received corn and tankage in dry lot. The average daily gains during the entire period of the lot which was started on forage were 1.14 lbs. and the feed requirements 273.32 lbs. of corn, 23.75 lbs. of tankage, and 0.1 acre of soy bean forage per 100 lbs. of gain. The pigs fed in dry lot throughout made average daily gains of 0.94 lb., requiring 390.98 lbs. of corn and 56.14 lbs. of tankage per 100 lbs. of gain. At the close of the grazing period, three hogs shipped to Beltsville, Md., killed soft, while of others shipped after 55 to 84 days finishing on corn and tankage half killed soft and half hard.

Hogging down forage crops [at the Pee Dee Substation].—In a comparative test of dry lot feeding of corn and tankage with hogging down peanuts, peanuts and sweet potatoes, and peanuts plus a 2 per cent corn ration, it was found that the most rapid gains were made on the last-named feed, while the cheapest gains were made on sweet potatoes and peanuts.

Protein supplements for hogs.—In comparisons of animal and protein supplements for hogs, mixtures of soy bean meal and fish meal, equal parts, when fed with corn, gave the most satisfactory results in rate and economy of gain. Peanut feed and fish meal were second, and in all cases where soy bean meal or peanut meal were used as the sole protein supplements the gains were more rapid and more economical than when tankage or fish meal furnished the only source of protein.

Alfalfa and horses, R. S. HUDSON (*Michigan Sta. Circ. 65 (1924), pp. 7, fig. 1*).—The preliminary results of experiments in comparing rations of corn and alfalfa hay with corn, oats, and timothy hay for work horses are reported. During the first 13 weeks of the experiment, which was conducted in the winter, one horse of each of nine teams received each of the rations. The horses receiving corn and alfalfa hay worked 472 days and gained a total of 740 lbs. at a calculated feed cost per day of 29.7 cts. The other horses receiving the contrasting ration worked a total of 430 days, lost a total of 30 lbs., and the calculated daily feed cost was 34.1 cts.

During the second period of like length, conducted in the spring of the year, the rations were reversed, but again the alfalfa ration proved superior in maintaining weight and the feed cost was less.

[*Poultry investigations at the Dominion experimental farms*], F. C. ELFORD (*Canada Expt. Farms, Poultry Div. Rpt. 1923, pp. 10-31, figs. 4*).—The following investigations have been conducted during the year 1923, many being continuations from the previous report (E. S. R., 50, p. 777):

Chick feeds and feeding.—In a comparison of different drinks for baby chicks, 5 lots were selected, each of which received one of the following drinks: Sour skim milk, sweet skim milk, sweet whole milk, sour whole milk, and water. The lowest mortality, 4 per cent, was recorded in the pens receiving sweet whole milk and water, and the highest, 13 per cent, in the pen receiving sweet skim milk. The greatest gains in weight, however, were made in the latter pen and the least in the pen receiving water.

The results of several experiments dealing with the addition of foods containing vitamins, such as canned tomatoes, yeast, and green feeds and curds to the ration of baby chicks showed practically no advantages for the additions of these feeds. In certain cases advantages were shown in the rate of gain of chicks on one of the foods, but such an advantage was usually counterbalanced by a greater mortality. The addition of yeast or canned tomatoes to a ration of dry or boiled rice did not produce normal growth in baby chicks in a 3-weeks' experiment, nor did the addition of raw liver, cod liver oil, or egg yolk to this basal ration produce growth at all comparable to that made on a standard ration.

Capons vs. Roasters.—In comparing the rates of fattening and economy of gains of capons and cockerels, 25 Barred Rock cockerels were caponized, of which 3 died soon after the operation. The gains of the other 22 capons were compared with 22 similar cockerels during a test period lasting from July 8 to December 13. In this period the capons gained an average of 5 lbs. 5 oz., and roasters made average gains of 5 lbs. 1 oz. The capons consumed an average of 18 lbs. 5 oz. of scratch grain, 11 lbs. 9 oz. of mash, and 4.8 gal. of milk, while the roasters consumed an average of 19 lbs. 2 oz. of scratch grain, 10 lbs. 3 oz. of mash, and 6.3 gal. of milk. The conclusion from the experiment is that the value of caponizing lies chiefly in the production of meat of superior quality, rather than in any greater efficiency of growth or fattening.

Feeding for winter egg production.—In a comparison of a commercial mash and a home mixed mash consisting of equal parts of bran, shorts, oat chop,

and corn meal, with 20 per cent beef meal, for egg production, it was found that the two lots laid exactly the same numbers of eggs. The fertility of the eggs laid by the birds receiving home mixed mash was 87.4 per cent, of which 35.6 per cent hatched, which was somewhat better than the fertility of the eggs produced by hens receiving the commercial mash, which was 58.8 per cent, of which 28.6 per cent hatched.

In comparing various sources of animal protein for egg production, 3 pens of birds were fed alike except that beef scrap, tankage, or fish meal was added to the mash in amounts of 20 per cent. The total numbers of eggs laid and their estimated cost per dozen were in the different lots, respectively, beef scrap 1,374 eggs and 12.5 cts., tankage 1,167 eggs and 12.4 cts., and fish meal 1,257 eggs and 13.6 cts. Fertility and hatchability differed somewhat on the rations, 71.4, 91, and 72.3 per cent of the eggs being fertile on the beef scrap, tankage, and fish meal rations, respectively. The hatching percentages of the fertile eggs were 34.4, 41.5, and 38.8. As in the earlier experiments, tankage was found to be an uneconomical substitute for beef scrap.

In another experiment, milk was compared with beef scrap as a source of animal protein, 1 pen of hens receiving milk but no beef scrap, whereas another pen received water, with 20 per cent beef scrap added to the mash, as well as beef scrap available in a self-feeder at all times. The former lot laid 1,045 eggs at an estimated cost of 14.7 cents per dozen, while the latter lot laid 1,201 eggs at an estimated cost of 15 cents per dozen. Of the eggs produced on the milk ration, 92.4 per cent were fertile, of which 45.2 per cent hatched, while on the beef scrap ration only 72.5 per cent of the eggs were fertile, of which only 18 per cent hatched. The beef scrap thus gave a higher production and greater profit, but the milk produced better hatching eggs at a slightly lower cost.

In a test comparing the egg production and hatching ability of eggs laid by hens receiving various green feeds or substitutes, 5 pens were selected and furnished with similar feeds with the following exceptions: Pen 1 mangels once a day; pen 2 sprouted oats once a day; pen 3 red clover leaves chopped and fed dry once daily; pen 4 mangels, sprouted oats, and clover; and pen 5 no green feed but 1.5 oz. Epsom salts per pen daily in the drinking water. The total eggs laid by the pens in numerical order were, respectively, as follows: 1,285, 1,403, 1,438, 1,393, and 1,414. The estimated costs per dozen eggs were 15.4, 12.1, 13.8, 13.7, and 13.1 cts. Practically 90 per cent or above of the eggs were fertile in all lots, though only 32 per cent of the fertile eggs hatched in the mangel-fed lot as compared with 50.8 per cent in the clover pen. It is thus concluded that clover gave the best results both in production and hatchability, with Epsom salts a close second.

In another test dealing with the addition of animal protein, a pen of pullets receiving both buttermilk and water to drink produced 1,535 eggs at an estimated cost of 12.9 cts. per dozen. Of these eggs, 75.3 per cent were fertile, of which 38 per cent hatched. A similar pen of pullets receiving only water to drink laid 1,139 eggs at an estimated cost of 15.9 cts. per dozen. Of these eggs, 94.1 per cent were fertile, of which 54.4 per cent hatched. It is, therefore, stated that milk has given the best results for production and profit, but better hatching resulted when no milk was given.

Duck feeding experiments.—The gains made by two lots of 45 ducklings each hatched early in June were compared, the one lot being furnished with green feed while the other received none. A similar comparison was made with two lots of 25 ducklings each hatched late in June. The ducks receiving green feed

made slightly better gains in both experiments, but contradictory results were obtained in the previous year. It is concluded that where access to small runs containing some green material is afforded, it is not necessary to feed additional green feed in the rations of green ducks.

Preserving and storing eggs.—In a study of the effect of various factors on the keeping qualities of eggs in storage, it was found that new-laid eggs were not in as good condition as determined by candling after storing for 6 months when they were treated by a commercial process as when they were untreated. Such decisive results were not obtained with commercial eggs, however, there being 11 per cent more extras but also more seconds and cracks among the processed eggs.

In a comparison of different types of cases, no superiority was shown in the use of a type of nonventilated case over the use of the usual common egg case. Of the eggs which were washed before storage, 63 per cent were graded as extras as compared with 53 per cent of clean eggs in another experiment. A comparison of the use of clean fillers with dirty fillers in the egg cases showed that eggs packed for storage in clean fillers and flats graded 3 per cent better than those packed in dirty fillers. The storage of eggs with the small end down produced over twice as many extras as when they were stored with the small end up. The comparisons for table use of processed and nonprocessed storage eggs were decidedly in favor of the processed eggs.

Comparative influences of various protein feeds on laying hens, R. M. SHERWOOD (*Texas Sta. Bul. 317 (1924), pp. 5-24*).—The results are reported of five experiments in which varying amounts of animal proteins have been replaced by cottonseed meal in the rations of laying hens.

Comparative value of meat scrap, tankage, and cottonseed meal for laying hens.—Eight pens of 19 Single Comb White Leghorn pullets each were used in this experiment which lasted from January 6 to August 31, 1920. The mash fed to these birds consisted as a basis of 125 parts of wheat bran, 75 parts of wheat shorts, and 100 parts of milo meal. The protein supplements to the basal mash in the different lots consisted of 100 parts of meat scrap, 83 parts of tankage, 85 parts of meat scrap and 20 parts of cottonseed meal, 71 parts of tankage and 20 parts of cottonseed meal, 70 parts of meat scrap and 40 parts of cottonseed meal, 58 parts of tankage and 40 parts of cottonseed meal, 55 parts of meat scrap and 60 parts of cottonseed meal, and 46 parts of tankage and 60 parts of cottonseed meal. The mash eaten per hen varied from 16.4 lbs. for the lot receiving the maximum amount of cottonseed meal with tankage to 22.2 lbs. for the lot receiving meat scrap only. The egg production varied from an average of 8.4 doz. per hen by the lot receiving 40 parts of cottonseed meal and 58 parts of tankage to 10.7 doz. by the lot receiving meat scrap only. Tankage gave as satisfactory results as meat scrap, but the animal proteins without cottonseed meal were not uniformly better than when cottonseed meal replaced part of the animal protein.

Comparison of fish meal and tankage with cottonseed meal for laying hens.—Four pens of 40 White Leghorn pullets were used in this test which was started November 2, 1920, and ended October 1, 1921. The animal protein used consisted of fish meal during the first 94 days and tankage during the succeeding 240 days. A mash of wheat bran, gray wheat shorts, and milo meal, 1:1:2, served as a basic feed, with protein supplements of 1 part of fish meal or tankage in one pen. In the other pens 15, 30, and 50 per cent of this protein was replaced by 19 lbs. of cottonseed meal for each 15 lbs. of the replaced animal protein, respectively. The feed consumption of all the pens was quite uniform, and the maximum difference in average egg production was only 0.9 doz.

Comparison of tankage with cottonseed meal for laying hens.—In this test, which continued from November 1, 1921, to September 21, 1922, three lots of 40 White Leghorn pullets each were fed. One lot received tankage in the ration, while the others had one-half or all of the tankage replaced by double the amount of cottonseed meal. The pen receiving only the cottonseed meal as a protein supplement laid an average of 12 doz. eggs per bird as compared with 10.6 and 10 doz., respectively, by the lots receiving the tankage only and the combination of protein supplements. The mortality in the cottonseed meal pen was highest, 5 hens dying as compared with 2 in the tankage pen. The feed cost for the eggs produced was lowest in the cottonseed meal pen.

Comparison of meat scrap with cottonseed meal for laying hens.—This experiment was similar to the preceding except that meat scrap was used in place of tankage, and the test was conducted from October 1, 1922, to August 31, 1923. The average egg production was 12.3 doz. by the meat scrap pen, 10.9 doz. by the cottonseed meal pen, and 10.8 doz. by the lot receiving the combined proteins.

Value of meat scrap, cottonseed meal, and alfalfa meal for laying hens.—This experiment differed from the preceding experiments in that the birds were confined in concrete yards without access to range. The time of the experiment was from October 1, 1922, to May 21, 1923. Four lots of birds were used. Two of the lots (1 and 3) received additions of 60 parts of meat scrap to a mash of wheat bran, gray wheat shorts, and white corn meal, 125:75:75, while the other two lots (2 and 4) had 120 parts of cottonseed meal added to the mash. Lots 3 and 4 also received additions of 25 parts of alfalfa meal to the ration. The mortality was as follows: Lot 1, 7; lot 2, 7; lot 3, 1 (killed because of canker); and lot 4, 3 (two with broken eggs in the oviduct). The pens not receiving the alfalfa meal were largely unhealthy, showing throat lesions and a nasal discharge. The average egg production per bird in the lots 1, 2, 3, and 4 were 7.3, 6, 8.5, and 8.1 doz., respectively.

After the first three months of the experiment, the pens receiving cottonseed meal laid practically as well as those receiving meat scrap. The hatching percentages of the eggs during a part of the experiment were determined as follows: Pen 1, 52; pen 2, 72; pen 3, 65; and pen 4, 66 per cent.

New chick feeding facts, E. B. HART, H. STEENBOCK, J. G. HALPIN, and O. N. JOHNSON (*Wisconsin Sta. Bul.* 371 (1924), pp. 24, figs. 16).—A popular account of the practical application of the results of the more recent chick feeding experiments, dealing especially with the importance and sources of vitamins and minerals in the ration.

Egg production, monthly costs, and receipts on New Jersey poultry farms, W. H. ALLEN (*New Jersey Stas., Hints to Poultrymen*, 13 (1925), No. 4, pp. 4).—A summary of the monthly records of production, costs, and returns from 30 poultry farms in the State keeping over 500 birds each. The records are for the season November, 1923, to October, 1924.

Fifth western Washington egg laying contest, MR. and MRS. G. R. SHOUP (*Western Washington Sta. Bimo. Bul.*, 12 (1925), No. 5, pp. 115-124).—An account of the fifth western Washington egg-laying contest conducted during 1923-24, with comparisons with earlier contests.

DAIRY FARMING—DAIRYING

Proceedings of the World's Dairy Congress (U. S. Dept. Agr., Dairy Div., *World's Dairy Cong. Proc.*, 1923, vols. 1, pp. X+743, figs. 31; 2, pp. VI+745-1599, figs. 55).—The following papers and various discussions in addition to those noted elsewhere were presented at the World's Dairy Congress, previously

discussed editorially (E. S. R., 49, p. 601): Address of Welcome, by C. E. Hughes (pp. 2, 3); Response to Address of Welcome [trans. title], by J. Maenhaut (pp. 4, 5); Welcome on Behalf of the Department of Agriculture, by H. C. Wallace (pp. 6-8); Presidential Address, by H. E. Van Norman (pp. 8-14); Dairy Products' Place in Improvement of Human Health, by H. C. Hoover (pp. 14-17); The International Dairy Federation [trans. title], by C. Porcher (pp. 41-45); The Dairy Cattle Associations and Their Work, by F. O. Lowden (pp. 65-69); The Relations Between the Manufacturer and the Producer, by B. H. Rawl (pp. 69-77); Address by the President of the United States, C. Coolidge (p. 108); Address of Welcome, by J. H. Moore (pp. 109, 110); Programs and Methods, by R. W. Balderston (pp. 112-114); Quality Control Work of the Dairy Council, by C. I. Cohee, jr. (pp. 128-130); Self-government in Industry, by G. Pinchot (pp. 135-138); The Relation of the Dairy Industry to Child Welfare, by Mrs. I. C. Wood (pp. 139-143); Production and Marketing of Dairy Products in England, by E. W. Langford (pp. 143-146); The Meat Packer as a Distributer of Dairy Products, by L. D. H. Weld (pp. 223-234); The Organization of United Dairies (Ltd.), by J. H. Maggs (pp. 235-242); Dairy and Factory Management, by A. Peter (pp. 242-245); The International Dairy Institute [trans. title], by A. C. Bovy (pp. 245-252); The Dairy Industry in Norway, by R. Mork (pp. 265-269); International Organization for the Utilization of Milk [trans. title], by E. Laur (pp. 270-272); The Pasteurization of Cheese, by S. K. Robinson (pp. 273-276); The Relation of Ensilage to Cheese Making, by R. Burri (pp. 278-287); The Use of Bacterial Cultures for Controlling the Fermentation in Emmental Cheese, by J. M. Sherman (pp. 287-290); New Developments in the Manufacture of Swiss Cheese, by K. J. Matheson (pp. 290-300); Some Milk Types Characterized by Their Rennin Reaction and Their Importance in Cheese Making, by G. Koestler (pp. 300-302); The Flora of American Commercial Cheddar Cheese and Its Relation to Quality, by G. J. Hucker (pp. 302-305); Pasteurization of Milk for Cheddar Cheese Making in New Zealand, by C. Stevenson (pp. 306-308); Relation of Lactic Bacteria to Cheese Ripening, by C. Gorini (pp. 308-310); Control of the Fermentative Processes in Italian Cheese Types [trans. title], by C. Gorini (pp. 311-314); The Connection Between the Bacterial Content of Milk from Which Cheese Is Made, and the Rapidity of Ripening of the Cheese, by C. Barthel and E. Haglund (pp. 314-321); The Use of Selected Lactic Ferments in the Manufacture of Hard-pressed Cheese, by R. H. Leitch (pp. 321-327); Bacterial Content of Grana Cheese while Ripening [trans. title], by G. D. Torre (pp. 327-329); The Ripening of Cheese, by F. W. J. Boekhout (pp. 330-336); Influence of the Acidification of Milk on the Water Content of White Cheese [trans. title], by Prokš (pp. 336-339); Experiments in the Manufacture of Rennet Extract, by R. H. Leitch (pp. 339-341); Mongolian Cheese, or "Naii Tofu," by M. Sato (p. 342); Methods of Disseminating Results of Research Concerning the Dairy Industry by Publications, by J. H. Frandsen (pp. 352-358); Development of the Dairy Industry in India, by T. Das (pp. 358-366); Educational and Advisory Work in Dairy Farming Through the Agency of Milk Recording Societies, by G. H. Garrad and J. Mackintosh (pp. 382-392); Milk Recording in Scotland, by W. Stevenson (pp. 392-399); Task of the Government Dairy Experts with Regard to Matters of Dairying, by A. J. Swaving (p. 400); Conference on Dairy Publications, by J. H. Frandsen (pp. 419, 420); Means by Which the Ice-cream Industry Has Been Developed in the United States, by M. Mortensen (pp. 466-474); The Preparation of Standardized Mix in Country Plants, by W. White (pp. 474-477); Factors Influencing the Crystallization of Lactose, by A. Leighton and P. N. Peter (pp. 477-488); Standardizing the Ice-

cream Mix, by W. B. Combs (pp. 488-500); Sandy Ice Cream, by C. D. Dahle (pp. 500-510); How Can We Best Safeguard Our Milk Supply? by C. J. Hastings (pp. 512-521); Health Department Organization in Developing a Municipal Pasteurized Milk Supply with a Final Bacterial Count under 15,000, by G. H. Hart (pp. 521-530); Methods Employed within the Industry to Improve the Quality of Milk, by C. D. Pearce (pp. 530-537); What Constitutes Efficiency in Pasteurization? by S. H. Ayers (pp. 541-549); The Supervision of the Pasteurization of Milk by State Authorities, by H. A. Whittaker (pp. 549-555); Quality Rates and Premiums in the Finnish Dairy Industry [trans. title], by O. P. Pehkonen (pp. 568-577); Definition of Pasteurization by Law, by B. van der Burg (pp. 578-582); Certified Milk, by W. H. Lee (pp. 582-585); Organized Effort to Improve Dairying in Czechoslovakia, by J. Kříženecký (pp. 593-603); Governmental Control of Butter and Cheese in Denmark, by S. Sørensen (pp. 745-749); Butter Control, by A. J. Swaving (pp. 749-758); Cheese Control, by A. J. Swaving (pp. 758-760); International Nomenclature for Cheese Brands, More Uniform Standards for Fat Control in Different Varieties of Cheese, Uniform Methods of Examination of Cheese, by A. J. Swaving (pp. 760-762); Cheese Nomenclature, by C. Porcher (pp. 762-764); The Coordination of Federal, State, and Municipal Control, by W. S. Frisbie (pp. 764-768); Creamery and Testers' License Laws, by H. W. Gregory (pp. 768-780); In Behalf of an International Control of the Cheese Trade [trans. title], by G. Fascetti (pp. 781-786); Butter Control in Belgium [trans. title], by C. Huyge (pp. 786-792); Uniform Nomenclature and Grade Standards of Quality as Applied to Butter, by M. A. O'Callaghan (pp. 795-798); Effect of Topographical Considerations on the Problems of Milk Distribution, by R. S. Williams and A. T. R. Mattick (pp. 800-805); Milk Transport in England, by J. S. Latham (pp. 806-811); Transportation of Milk in Bulk, by J. P. Dugan (pp. 812-817); Bulk Transportation of Milk by Rail, by H. E. Black (pp. 817-824); The Transportation of Milk by Means of Tank Motor Trucks, by C. E. Gray (pp. 825-830); The Costs of Milk Delivery, by A. B. Gardiner (pp. 833-835); Problems by Which the City Milk Dealer Is Confronted, by J. Le Feber (pp. 851-855); Methods of Buying and Selling Milk, by C. G. Morris (pp. 855-863); Work of the National Dairy Council in Bringing About a Greater Use of Milk, by M. O. Maughan (pp. 863-865); Some Problems of Milk Distribution, by B. Davies (pp. 866-868); The Production and Distribution of Milk in the Vicinity of Lyons [trans. title], by R. Guyot-Sionnest (pp. 875-880); The Methods of Milk Collection, Treatment, and Distribution Used by the Belfast Cooperative Society, Limited, by J. Hill (pp. 880-883); The Different Systems of Handling Milk in Italy [trans. title], by G. Fascetti (pp. 883-887); The Education of the Producer as to the Value of a Better Product as a Means of Increasing Sales, by L. T. C. Schey (p. 888); The Russian Dairy Industry, by G. N. Kaminsky, A. B. Serejnikoff, and A. P. Yurmaliat (pp. 949-958); Development of the Central Creamery, by T. A. Borman (pp. 959-966); The Influence of Salt on the Flavor of Butter, by A. C. Dahlberg (pp. 966-974); Fishy Flavor in Butter, by H. H. Sommer (pp. 974-985); The Action of the Organisms Present in the Starters Used in Butter Making, by B. W. Hammer (pp. 985-993); Some Factors Relating to the Production of Cream for Butter Making in New Zealand, by W. Dempster and G. M. Valentine (pp. 993-997); The Commercial Significance of the Variable Constituents of Creamery Butter, by J. R. Keithley (pp. 997-1004); The Importance of the Equilibria in the System Milk Fat in the Making of Butter, by W. van Dam (pp. 1004-1008); The Formation of Butter in Churning [trans. title], by O. Rahn (pp. 1008-1013); The Physiology of Milk Secretion, by C. Porcher (pp. 1016-1018); Some Aspects of the Physiology of the Mammary

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for Milk Production, by R. R. Graves (pp. 1375-1383); The Wisconsin Experiment in Crossbreeding Cattle, by L. J. Cole (pp. 1383-1389); The Inheritance of Milk Production and Butterfat Percentage, by J. W. Gowen (pp. 1389-1396); Causes of Variation in Milk Secretion and Their Bearing on Practical Breeding Methods, by T. U. Ellinger (pp. 1396-1401); Cattle Breeding and Inbreeding, by M. A. O'Callaghan (pp. 1401-1405); Milk Yields and Associated Factors as Shown by the Scottish Milk Records Association, by J. F. Tocher (pp. 1405-1416); Dairy Animals in Italy [trans. title], by A. Pirocchi (pp. 1416-1423); Dairying in Brazil, by A. de Vasconcellos (pp. 1423-1437); Dairy Farming in Japan, by M. Sato (pp. 1437-1451); and details regarding the organization of the congress (pp. 1529-1558).

Relative utilization of energy in milk production and body increase of dairy cows, J. A. FRIES, W. W. BRAMAN, and D. C. COCHRANE (*U. S. Dept. Agr. Bul. 1281 (1924), pp. 36, fig. 1*).—This bulletin reports the results of a metabolism experiment with dairy cows conducted cooperatively by the Institute of Animal Nutrition of Pennsylvania State College and the U. S. Department of Agriculture. Three mature cows were used for the tests. The animals received the same ration of grain and alfalfa hay throughout the experiment, the ration being calculated to maintain milk production and produce an increase in live weight as lactation advanced. Two of the cows were fed during three periods, while the results on the third animal are only for two periods. Each period was divided into a preliminary portion and a digestion experiment of at least 9 days' duration. The animals were also placed in the respiration calorimeter for 48 hours during the last 10 days of each period. The usual analyses of feed, excreta, and milk were made during the digestion periods, as well as determinations of the gas and heat metabolism while in the respiration calorimeter. The amount of methane lost and the heat of fermentation were found to affect markedly the efficiency of digestion of the energy in the dry matter of the ration. The manner of considering the milk as body gain or by ignoring it also had a distinct effect on the digestibility of the ration.

The results indicated that milk production takes place by a more direct method than through the transformation of body tissue, since there was a 22.32 per cent greater utilization of the net energy of the feed for milk production than for body increase. The computed heat production of the cows was from 2 to 3 per cent higher than that measured by the calorimeter, indicating that the measured heat production is slightly less than that actually produced. There was an increase of about 2 per cent in the heat production of animals during the last stages of gestation as compared with similar nonpregnant cows. The excess energy required for standing over lying was similar in amount to that found in earlier experiments with steers.

A special container devised by the senior author for collecting the excreta from the cow in the respiration chamber is described.

[Experiments with dairy cattle at the South Carolina Station] (*South Carolina Sta. Rpt. 1924, pp. 67, 68, 70, 71*).—The results of various experiments with dairy cattle are reported.

Preliminary milking for two-day tests.—In tests of the influence of leaving milk in the udder on the butterfat yield during the succeeding two days, it was found in the 12 trials that in 9 there was an increase in the butterfat yield, in 10 an increase in the butterfat percentage, and in 7 an increase in the milk yield.

Comparative value of corn and sorghum silage.—The results of the comparative study of corn and sorghum silage were much as in the previous year

(E. S. R., 50, p. 679). It required 165 lbs. of corn silage or 181 lbs. of sorghum silage to produce 100 lbs. of milk. The corn silage, however, cost 1.78 times as much to produce.

Calf feeding.—The results of a comparative test of hand-feeding and self-feeding grain to calves are reported. The experiment lasted nine weeks, during which one lot of calves was hand-fed twice daily a ration of 100 parts corn meal, 100 parts ground oats, 100 parts wheat bran, 50 parts linseed meal, and 3.5 parts salt, while the other lot had access in separate compartments of a self-feeder to shelled corn, wheat bran, linseed meal, whole oats, corn meal, ground oats, velvet bean meal, bone meal, salt, and ground limestone. The self-fed calves showed a preference for whole corn and oats as compared with the ground grains. The average gains in weight of the two lots were similar, being 143 lbs. for the self-fed lot and 137 lbs. for the hand-fed animals. The hand-fed group, however, gained 5.48 in. in height as compared with 3.32 in. by the self-fed group. It is pointed out that the gain in bony growth was more desirable for animals of this age than the fattening tendency of the self-fed calves. The calculated costs per pound of gain were 12.4 cts. for the self-fed group and 10.4 cts. for the hand-fed group.

Effect of feeding cabbage and potatoes on flavor and odor of milk, C. J. BABCOCK (U. S. Dept. Agr. Bul. 1297 (1924), pp. 12, figs. 4).—Six Holstein and 10 Jersey cows were divided into four groups for the study of the effect of the feeding of cabbage and potatoes on the flavor of the milk produced, as was done with turnips and other succulent feeds in earlier investigations (E. S. R., 50, p. 377). The results of the opinions of the judges of the flavor and odor of the milk produced while on these feeds were as follows:

Classification of samples of milk produced by cows receiving cabbage and potatoes

Kind of feed	Flavor				Odor			
	Normal	Very slightly off	Slightly off	Off	Normal	Very slightly off	Slightly off	Off
Basal ration (check for cabbage).....	<i>Per ct.</i> 94.2	<i>Per ct.</i> 4.6	<i>Per ct.</i> 1.2	<i>Per ct.</i> 0	<i>Per ct.</i> 93.8	<i>Per ct.</i> 4.60	<i>Per ct.</i> 1.60	<i>Per ct.</i> 0
15 lbs. of cabbage 1 hour before milking.....	34.0	28.0	22.9	15.1	30.3	31.70	26.20	11.8
30 lbs. of cabbage 1 hour before milking.....	19.6	21.2	25.7	33.5	16.8	22.60	28.50	32.1
30 lbs. of cabbage immediately after milking.....	76.2	13.6	8.5	1.7	79.0	9.65	9.65	1.7
Basal ration (check for potatoes).....	96.0	3.6	.4	0	96.9	2.20	.90	0
15 lbs. of potatoes 1 hour before milking.....	87.7	8.6	3.7	0	87.7	7.40	4.90	0
30 lbs. of potatoes 1 hour before milking.....	88.7	7.9	3.4	0	88.2	7.30	4.50	0
30 lbs. of potatoes immediately after milking.....	96.4	3.6	0	0	97.0	2.40	.60	0

The results showed that the feeding of cabbage before milking produced abnormal flavors and odors in the milk, which were increased by increasing the amount of cabbage fed. The flavors were also more pronounced in the cream than in the milk. Aeration was found to reduce the objectionable flavors and odors in the milk. Potatoes consumed one hour before milking had a slight tendency to produce objectionable flavors and odors, but the extent was not increased with an increase in the amount of potatoes consumed. Both potatoes and cabbage could be fed after milking without the development of serious objectionable flavors and odors.

Raising the dairy calf when whole milk is sold, C. H. ECKELS and T. W. GULLICKSON (*Minnesota Sta. Bul.* 215 (1924), pp. 3-30, figs. 13).—This bulletin reports the results of experiments in raising calves with minimum amounts of whole and skim milk and with powdered skim milk, malted milk, and powdered and semisolid buttermilk. The part dealing with the desiccated milk products has been previously noted (E S. R., 49, p. 473; 51 p. 778.)

Eighteen calves divided into five groups were used in the study of the minimum whole and skim milk requirements. Three of the groups received whole milk until weaning at from 50 to 72 days of age. Group 4 received part skim milk after 40 days, while group 5 received only skim milk after 4 weeks of age. The calves of groups 1, 2, and 5 were grade Holsteins, while group 3 consisted of purebred Jerseys and group 4 of grade Guernseys. All calves had access to grain and alfalfa hay, the former being limited to 5 lbs. per head daily. When whole milk only was fed, the Holstein calves required from 432 to 879 lbs., while the jerseys required 572 lbs. each. With skim milk the Holsteins required from 161 to 178 lbs. of whole milk and 378 lbs. of skim milk, while the Guernsey required from 360 to 506 lbs. of whole milk and from 72 to 103 lbs. of skim milk.

The gains in weight and height of the calves were compared with the normal to 180 days of age. It was found that the calves were somewhat below normal in weight for some time after weaning, but this was no more evident for those weaned at 50 days than in other groups. Height was less affected by the feeding than was weight. It is stated that these calves will attain normal growth by 2 years of age.

The bacterial flora of milking machines, A. H. ROBERTSON (*New York State Sta. Tech. Bul.* 105 (1924), pp. 3-52).—The results are reported of a study of the morphology, motility, spore formation, chromogenesis, Gram stain gelatin liquefaction, nitrate reduction, fermentation of dextrose, lactose, and saccharose, and litmus milk reactions of 721 cultures isolated from various parts of milking machines used in 42 dairies. The cultures have been tabulated according to the genera, with characteristics of each, and described by the numerical system recommended by the Society of American Bacteriologists.

There appeared to be some relation between the care given the milking machines and the flora found. In general the group of white Gram-positive micrococci was the most common when the machines received relatively good care by cleaning with brine hypochlorite solutions. Gram-negative rods of *Streptococcus lactis* types were more prevalent when conditions were less sanitary. Alkali-forming rods were found in connection with tubes cleaned by submerging them in cold water or weak sterilizing solutions. Various other forms were also found, including yeasts and molds. The types found were no more harmful than those on other dairy utensils, but under poor conditions the quantities gaining access to the milk from the milking machine may be greater.

Filtration and clarification of milk, A. C. DAHLBERG and J. C. MARQUARDT (*New York State Sta. Tech. Bul.* 104 (1924), pp. 3-27 pls. 4 fig. 1).—The effect of clarification and filtration on the various qualities of the milk has been investigated by comparing portions of the same milk after filtration or clarification with the original raw milk. The filters used in this study were the Burrell-Simplex No. 8, the Ladd filter No. 7, and the Creamery Package No. 6. Clarification was done with the De Laval clarifiers Nos. 95 and 120. The results of the laboratory findings were verified in commercial milk plants.

Both clarification and filtration removed the visible sediment, but by microscopic examination it was found that filtration did not remove all invisible particles (less than 0.02 to 0.05 mm. in diameter), though they were apparently

removed by clarification. Neither method of removing the sediment affected the composition, flavor, acidity, nor keeping quality of the milk. Clarification at a high temperature tended to decrease the size of the cream layer, due to a reduction in the size of the fat globules, while filtration had no effect. The optimum temperature for clarification was 40° F. Bacterial studies of the milk showed that clarification broke up the large clumps of bacteria, while filtration had no effect. Clarification reduced the cell content of the milk 67.3 per cent, while filtration had no influence in this respect.

Successful cream whipping, J. C. HENING (*New York State Sta. Circ.* 77 (1924), pp. 4, fig. 1).—Directions for whipping cream.

Ice cream formulas and standardization, H. P. DAVIS, P. A. DOWNS, and B. MASUROVSKY (*Nebraska Sta. Bul.* 203 (1924), pp. 3-23).—This consists mainly of a presentation of formulas for various kinds of ice cream, including a classification of ice creams and directions for standardizing mixes.

VETERINARY MEDICINE

Lang's German-English dictionary of terms used in medicine and the allied sciences, edited and rev. by M. K. MEYERS (*Philadelphia: P. Blakiston's Son & Co.*, 1924, 3. ed., enl., pp. VII+613).—The third edition of this glossary of German medical terms is said to contain approximately 53,000 definitions, including over 4,000 new terms.

Animal diseases in southern Brazil [trans. title], F. SCHMIDT (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 39, pp. 532-534).—A brief account of the occurrence of the more important infectious diseases of domestic animals in southern Brazil.

Annual report on the occurrence of infectious diseases of animals in Germany [trans. title] (*Jahresber. Verbr. Tierseuch. Deut. Reiche*, 32 (1920-1921), pp. IV+56+56).—This continuation of the reports previously noted (*E. S. R.*, 50, p. 182) covers the years 1920 and 1921.

A new clinical method for blood typing, O. M. GRUHZIT and L. T. CLARK (*Jour. Lab. and Clin. Med.*, 10 (1924), No. 1, pp. 66-68, figs. 2).—The authors describe a simple test which may be completed in 5 to 10 minutes.

Specific dressings.—**A study of local immunity** [trans. title], A. BESREDKA (*Ann. Inst. Pasteur*, 38 (1924), No. 7, pp. 565-580).—Essentially noted from another source (*E. S. R.*, 50, p. 78).

The relation of the melitensis-abortus group of organisms to human health, A. C. EVANS (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.*, 1923, vol. 1, pp. 562-568).—In this paper the author deals with the present status of knowledge of this group of pathogenic organisms. The account is based upon investigations by the author, previously noted (*E. S. R.*, 39, p. 289; 49, p. 380; 50, p. 183; 51, p. 283), and of others. The author concludes that, if there were no other reason for milk pasteurization, it would appear to be folly to drink raw milk containing the *abortus* organism. Recent accounts of investigations by Keefer (*E. S. R.*, 50, p. 684), Auricchio (*E. S. R.*, 51, p. 81), and Burnet (*E. S. R.*, 51, p. 181) have been noted.

On the serological differentiation of *B. abortus* and *B. melitensis* [trans. title], H. FUTAMURA (*Jour. Japan. Soc. Vet. Sci.*, 3 (1924), No. 2, pp. 127-147).—In attempts to differentiate between *Bacterium abortus* and *B. melitensis*, the only point of differentiation appeared to be the agglutination with heated antigen. On heating the antigen to from 60 to 100° C. for an hour, *B. abortus* was agglutinated more powerfully than *B. melitensis*.

A study of the agglutination test for bovine infectious abortion, F. P. MATHEWS (*Jour. Infect. Diseases*, 35 (1924), No. 5, pp. 498-501).—In the study

reported an antigen was prepared by growing three different cultures of *Bacillus abortus* on agar for 48 hours and washing off the growth with phenolized salt solution. This antigen was diluted to correspond with a turbidity of 3 in the McFarland nephelometer, a definite amount of this dilution was further diluted with an equal amount of phenolized salt solution, and a portion of the second dilution was treated in the same manner. The 3 antigens thus prepared were tested with the sera of 170 cows from 9 herds, the test being made at the end of 18- and 42-hour incubations, respectively.

The results obtained were divided into three groups, the first comprising the sera from 82 animals, all of which gave negative results with antigen 1, 53 negative with antigen 2, and 21 negative with antigen 3; the second the sera of 8 animals reacting alike at the 18-hour reading and giving a titer of 1 to 25 with antigen 1, 1 to 50 with antigen 2, and 1 to 100 with antigen 3; and the third the sera of the 80 remaining animals, all of which gave higher reactions than the other groups. The titers in groups 2 and 3 showed that a definite ratio exists between the amount of serum and the number of organisms in the antigen when the titer of the serum is reached, and that as the turbidity decreases the agglutinability increases.

The results obtained at the forty-second hour reading were inconstant with antigens 2 and 3, and are thought to indicate that after 18 hours the reaction becomes nonspecific.

Tests with antigens varying in H-ion concentration between pH 6 and 8 indicated no variation in agglutinability with a change in H-ion concentration.

In the particular herds studied the average titer of positively reacting sera was higher in herds in which the abortions had persisted for some time than in those in which the disease was of shorter duration.

Studies on a non-virulent living culture of *Bact. abortus* towards protective vaccination of cattle against bovine infectious abortion (Bang's abortion disease), I. F. HUDDLESON (*Michigan Sta. Tech. Bul.* 65 (1924), pp. 3-36).—The avirulent strain of *B. abortus* used in previous immunization experiments conducted on guinea pigs (*E. S. R.*, 52, p. 481) has been tested similarly on cattle, including 23 animals in an experimental herd and 118 in five other herds.

The general procedure was to administer subcutaneously 10 cc. of a bacterin prepared from the avirulent strain by sterilization with phenol and to follow this after a week's interval by the same dose of a living culture. The blood of each animal was examined by the complement fixation and agglutination tests before and after the inoculation. Similar tests were also made with the milk, and the milk fetuses and fetal membranes were examined bacteriologically and the results confirmed by guinea pig inoculation. Routine clinical examinations were made throughout. In the experimental herd the animals, when treated, were grouped according to their previous histories of abortion and blood reaction.

Six pregnant heifers, which had no history of abortion and gave negative blood tests, were exposed to natural infection after the inoculation. All gave birth to normal calves, and *B. abortus* was not recovered from the uterus nor milk of a single animal. Antibodies for *B. abortus* were absent or slight at the time of parturition but increased rapidly after the injection, declining slowly again after about 60 days. In all but one case, the antibody content of the milk was low. The blood sera of the calves were negative before and after nursing.

Four pregnant heifers which had previously shown a positive blood reaction to one or both tests were subjected to artificial infection after inoculation. Three calved normally, the fourth being accidentally killed.

In a group of 10 cows having a history of abortion or a positive blood test at the time of treatment, 3 showed no evidence of the disease after treatment, nor was *B. abortus* found in the uterus or the milk. Of the remaining 7, 2 of which had aborted previously, 5 were pregnant at the time of vaccination and the other 2 became so later. Of the entire number, 5 aborted, and *B. abortus* was recovered from either the milk or the uterus of all. Two cows which had never given a positive blood reaction nor aborted were injected intravenously with living vaccine. Both were slaughtered before calving and showed no evidence of *B. abortus* in any of the organs tested, including the fetuses. As a check on these results, 2 heifers were given intravenous injections of a virulent strain of *B. abortus*, and this was later recovered in the uterus and fetus.

The effect of the treatment of herd cattle with killed and living avirulent cultures is shown by the breeding efficiency after treatment, which varied from 78.6 per cent to 100 per cent. In the controls receiving no treatment, the breeding efficiency ranged from 0 to 86.6 per cent.

The data are thought to indicate that the culture studied has lost its virulence for cattle as well as for guinea pigs, and that some degree of immunity follows its inoculation. Attention is called, however, to the fact that not all abortions are due to *B. abortus*. "It is certainly evident that all breeding troubles will not be solved alone by giving the animal protection against *B. abortus* infection. If the vaccine proves to be of value in the fight against this one disease of the genital organs, then its application, together with the necessary clinical treatment for other diseases of the reproductive organs, should reduce the abortion rate and breeding trouble in cattle to a small percentage. The use of this nonvirulent culture of *B. abortus* is still in the experimental stage as regards its virulence and value as an immunizing agent. Further, it is not certain that the correct dosage or route of injection is being used. It will require many years of work and entail much expense before all uncertain factors are made clear."

Investigations upon flagellate infections, R. P. STRONG (*Amer. Jour. Trop. Med.*, 4 (1924), No. 4, pp. 345-374, pls. 6).—In the course of the author's investigations, a flagellate parasite was discovered in three species of *Euphorbia* in Central and South America, in which it produces flagellosis. The coreid bug *Chariesterus cuspidatus* was found to transmit the infection from the plant to a species of lizard. Extensive experiments upon animals demonstrated that the flagellate as it occurs in the plant and also in the intestinal tract of the insect is not pathogenic for vertebrates. However, after it has passed through the insect to the lizard it acquires pathogenic properties and may give rise to a form of tropical ulceration in the skin.

Experimental treatment of "mal de caderas" with Bayer 205 [trans. title], R. DIOS (*Compt. Rend. Soc. Biol. [Paris]*, 91 (1924), No. 31, pp. 1032, 1033).—The author's experiments, together with those of others, have led him to conclude that Bayer 205 is useful in combating mal de caderas in the north of Brazil.

Report of experimental work to determine whether avian tuberculosis is transmitted through the eggs of tuberculous fowls, C. P. FITCH, R. E. LUBBEHUSEN, and R. N. DIKMANS (*Jour. Amer. Vet. Med. Assoc.*, 66 (1924), No. 1, pp. 43-53).—The authors' investigations, details of which are presented in tabular form, have led to the conclusion that the egg is of no considerable significance in the transmission of avian tuberculosis. Of 62 hens used, only 43 laid, indicating that as high as 30 per cent of tuberculous hens in all stages of the disease may not produce eggs. Of 876 eggs examined, 367 by culture

and 509 by inoculation, the germ of tuberculosis was found in the composite of 9 eggs, but this does not imply that all of the 9 eggs contained tubercular bacteria, since they came from 2 different hens and only an occasional egg from these hens actually contained the germ.

"It would be safe to conclude from these results that less than 1 per cent of eggs from tuberculous fowls actually contain living tubercle bacteria. It has been shown, however, that chicks may be hatched from artificially infected eggs, and it is possible that a naturally infected egg might hatch and the chick itself be actually tuberculous. The possibility of this actually occurring under field conditions and, further, that it would result in the active spread of disease is quite remote."

The shells of 209 eggs coming from known tuberculous birds were carefully washed in sterile saline, the saline centrifuged, and the sediment injected intraperitoneally into poultry with a view to determining whether the disease is disseminated through their becoming soiled with feces containing the bacillus. The results obtained were negative in all cases.

Diseases of dairy cattle (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1453-1528, fig. 1*).—Addresses presented before the congress include: Protozoan Diseases of Dairy Cattle, by A. Theiler (pp. 1453-1460); Diseases of the Digestive System of Cattle, by D. H. Udall (pp. 1461-1467); Bovine Mastitis, by F. S. Jones (pp. 1468-1473); Mastitis, by J. N. Frost (pp. 1473-1481); Bovine Tuberculosis Control, by V. A. Moore (pp. 1482-1488); Investigations on the Pathology of Streptococcic Mastitis and on the Transmission of Mastitis through Milking Machines, by O. E. Stenström (pp. 1489-1493); Osteomalacia and Its Occurrence in Cattle in Norway, by P. Tuff (pp. 1494-1501); Control of Foot-and-mouth Disease in Europe¹ [trans. title], by R. von Ostertag (pp. 1501-1512); Sterility in Dairy Cattle, by W. L. Boyd (pp. 1512-1519); and The Present Status of Our Knowledge of Abortion Disease, by C. P. Fitch (pp. 1519-1528).

International trade in dairy cattle, J. R. MOHLER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 26-33*).—Regulations governing the importation and exportation of livestock, formulated with a view to preventing the dissemination of parasitic and microbial diseases, are discussed.

The piroplasms found in bovines.—I, The Theilerias [trans. title], E. BRUMPT (*Ann. Parasitol. Humaine et Compar., 2 (1924), No. 4, pp. 340-353, figs. 3*).—In this first paper, on Theileria, the species *T. annulata*, *T. dispar*, and *T. mutans* are dealt with. A bibliography of 20 titles is included.

Experiments with anti-hog cholera serum and hog cholera virus, E. W. PORTER (*Vet. Alumni Quart. [Ohio State Univ.], 12 (1924), No. 2, pp. 38-41*).—To throw some light on post-vaccination troubles in hog cholera immunization work, a study was made of the effect of using (1) large doses of serum and (2) virus which had been held at high temperature.

In the first test three litters of pigs of the same age were treated with the same amount of virus, 2 cc., and amounts of serum varying from 5 to 40 cc. One litter, which was kept under farm conditions in cholera-free territory, was tested for immunity about 6 months later and one which had been kept in a laboratory about 8 months later. In both cases the immunity remained absolute. The third litter, which had been sold and was fed on city garbage, was not tested, but remained healthy. It is concluded that large amounts of serum can be given without decreasing the immunity secured.

To test the effect of heat, samples of carbolized and uncarbolized virus were held at temperatures of 50, 70, and 99.5° F. and tested for virulence on the

¹ Also in *Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 36, pp. 481-484.

eighth and fifty-seventh days. In the tests with virus held for 8 days, all of the pigs developed symptoms within 7 days, the time of death showing little variation. In the lot injected with virus which had been held for 57 days there was a slightly slower reaction, but with little difference as a result of the different temperatures used. At the end of this time both carbolized and uncarbolized virus appeared to be badly contaminated.

Investigations of the extensive outbreak of Borna disease of the horse in Hesse [trans. title], W. ZWICK and O. SEIFRIED (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 35, pp. 465-471, figs. 7).—The authors report upon investigations of an outbreak of this disease in Oberhessen, where it has not previously been known to occur so extensively. A list of 34 references to the literature is included.

The frog as the second intermediate host of a trematode parasite of the duck and hen [trans. title], W. NÖLLER and C. WAGNER (*Berlin. Tierärztl. Wchnschr.*, 39 (1923), No. 44, pp. 463, 464).—The authors find that the frog is a host of the cercaria of *Hypoderaeum conoideum* (Bloch) = *Echinostomum conoideum* (Bloch) Kowalewski (1898), a parasite of the duck and hen. Encapsulation takes place in the kidneys of the tadpole and the young frog, and the parasite is later consumed with the frog host by the fowl. A list is given of six references to the literature.

Development of the liver fluke up to cercaria in *Limnaea stagnalis* [trans. title], W. NÖLLER and K. SPREHN (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 29, pp. 369, 370).—The authors' investigations show that the miracidia of the liver fluke (*Fasciola hepatica* L.) may penetrate young snails of *L. stagnalis* Schnkn. and pass their development to the cercarial stage.

The influence of diet upon the liver injury produced by carbon tetrachloride, N. C. DAVIS (*Jour. Med. Research*, 44 (1924), No. 5, pp. 601-614, pls. 2).—Experiments conducted by the International Health Board of the Rockefeller Foundation upon dogs are reported which show conclusively that factors of diet exert an enormous influence upon the toxicity of carbon tetrachloride.

"Mixed diets and high protein diets, which may be considered normal for dogs, are more or less protective. High carbohydrate diets afford very striking protection against liver injury. Starvation, on the other hand, is harmful. 'All-fat' diets preceding carbon tetrachloride administration are conducive to a maximal injury of liver parenchyma."

RURAL ENGINEERING

Hydrodynamics, H. LAMB (*Cambridge: Univ. Press*, 1924, 5. ed., pp. XVI+687, figs. 86).—This is the fifth edition of this book, the first edition of which was published in 1879. It contains chapters on the equations of motion, integration of the equations in special cases, irrotational motion, motion of a liquid in two dimensions, irrotational motion of a liquid—problems in three dimensions, on the motion of solids through a liquid—dynamical theory, vortex motion, tidal waves, surface waves, waves of expansion, viscosity, and rotating masses of liquid.

Semi-circular weirs calibrated at Purdue University, F. W. GBEVE (*Engin. News-Rec.*, 93 (1924), No. 5, pp. 182, 183, figs. 2).—The results of tests of semi-circular weirs of six different sizes of opening are presented and discussed, and the equation representing the flow from such a weir opening is deduced.

Farm drainage methods (survey and design), 1908-1922, H. B. ROE (*Minnesota Sta. Bul.* 216 (1924), pp. 5-71, figs. 22).—A large amount of routine

engineering information is contained in this bulletin on methods of survey and design of farm drainage systems, which is based on experience at the station from 1908 to 1922, inclusive.

Farm drainage methods (construction), 1908-1922, H. B. ROE (*Minnesota Sta. Bul.* 217 (1924), pp. 5-44, figs. 51).—A large amount of routine information on the construction of farm drainage systems is presented, which is based on experience at the station during the period 1908-1922.

The deterioration and preservative treatment of timber, A. S. DAWSON (*Engin. Jour. [Canada]*, 7 (1924), No. 8, pp. 558-563, fig. 1).—This is an economic discussion of the subject in which data are presented on deterioration in structural timbers and the economic value of preservative treatment. Records of results from the treatment of timber are tabulated.

Relation of temperature and pressure to the absorption and penetration of zinc chloride solution into wood, J. D. MACLEAN (*Amer. Wood Preservers' Assoc. Proc.*, 20 (1924), pp. 44-71, figs. 8).—Studies conducted by the U. S. D. A. Forest Products Laboratory are reported which showed that high solution temperatures are very effective in improving the absorption and penetration of zinc chloride in wood. There is a limit above which the temperature-pressure combination should not go if collapse is to be avoided. This limit is apparently higher for large pieces than for small ones, and higher for some species than others.

It is believed that the use of high temperatures in the zinc chloride treatment will not only result in better treatment but will bring about considerable saving in cost of operation, by shortening the time of treatment or by eliminating steaming.

Crushed brick makes good concrete block (*Concrete [Detroit]*, 25 (1924), No. 3, pp. 91, 92).—The results of experiments are briefly reported which showed that crushed brick aggregate, while a little harsher to work than a mixture of screenings and torpedo sand, is as easy to work as a straight torpedo mixture, and for a given amount of cement and a given fineness modulus of the aggregate will produce concrete of about the same strength as when ordinary aggregates are used.

Popular mechanics concrete handbook No. 1 (*Chicago: Popular Mechanics Press*, [1923], pp. [3]+88, figs. 138).—The use of concrete in the manufacture of small useful articles around the farmhouse and garden is briefly described.

Public Roads, [December, 1924] (*U. S. Dept. Agr., Public Roads*, 5 (1924), No. 10, pp. 24, figs. 27).—This number of this periodical contains the status of Federal-aid highway construction as of November 30, 1924, together with the following articles: *Accurate Accelerometers Developed by the Bureau of Public Roads*, by L. W. Teller (see below); *Highway Traffic in California*, by L. I. Hewes; *The Economical Use of Wheel Scrapers*, by J. L. Harrison; and *North Carolina Investigating Pressure on Pipe Culverts*.

Accurate accelerometers developed by the Bureau of Public Roads, L. W. TELLER (*U. S. Dept. Agr., Public Roads*, 5 (1924), No. 10, pp. 1-9, figs. 15).—Accelerometers developed in connection with the well known studies of impact of trucks on pavement are described, and data from their calibration are tabulated.

Laboratory strength-tests of motor-truck wheels, T. W. GREENE (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 2, pp. 150-155, 174, figs. 13).—Laboratory tests conducted at the U. S. Bureau of Standards with two each of standard wood, cast steel, I-beam type, steel disk, aluminum, and rubber cushion motor truck wheels are reported.

In radial compression all of the wheels were sufficiently strong to withstand any load to which they might be subjected in service. With reference to the

specific strength and resiliency developed in both the radial compression and side thrust tests, the results indicated that the wood wheel is probably the best adapted for motor-truck service. Although the other wheels developed considerably higher ultimate strengths, particularly the cast steel and the special steel disk wheel, the proportional limit of the wood wheel was only about 20 per cent less than that of any of the other wheels. The specific strength was higher for the wood wheel than for the others except the aluminum wheel. This was also true of the elastic resiliency and the elastic resiliency per pound of weight.

California air-cleaner tests, 1924 series, A. H. HOFFMAN (*Jour. Soc. Automotive Engin.*, 15 (1924), No. 2, pp. 140-148, figs. 8).—In a contribution from the California Experiment Station, the results of a continuation of the tests of tractor engine air cleaners begun in 1922 (E. S. R., 49, p. 688) are reported.

In the 1924 work road tests of air cleaners were conducted, efforts being made to find out how much dust an engine would draw in if the cleaner and connections were removed, and to catch and weigh the dust the air cleaner being tested failed to catch. The absolute air cleaner used in connection with the air cleaners being tested is described, and standard dusts for testing purposes, including fuller's earth, are discussed. Road tests are treated generally and specifically and compared with laboratory tests, and the 32 air cleaners submitted for testing are described. Tabular data of the test results are included.

It was found that every air cleaner built can be made to test 100 per cent efficient if a shrewd choice is made of the dust to be fed into it. The particles must be large enough so that they can not pass the filter, and must be heavy enough so that inertia or gravity will leave them behind when the air going toward the carburetor swings around the turn.

Specific heats of lubricating oils, E. H. LESLIE and J. C. GENIESSE (*Indus. and Engin. Chem.*, 16 (1924), No. 6, pp. 582, 583, fig. 1).—In studies conducted at the University of Michigan the specific heats of six typical lubricating oils were measured over a range of temperatures of from 37.78 to 143.33° C. (100 to 290° F.). An increase of from 35 to 40 per cent in specific heats was found. It is considered obvious that a change as large as this must be taken into account in engineering work. The variation of specific heats with temperature is not the same for all oils, and it is suggested that further study may disclose some connection between the temperature rate of change of specific heats and the properties of an oil as a lubricant.

A discussion of creep in power belting, R. F. JONES (*Cement and Engin. News*, 36 (1924), No. 9, pp. 21, 22, 24, figs. 3).—This is an analysis of the effect of creep on the application of the fundamental belting formula.

Plow bolts (*U. S. Dept. Com., Off. Sec., Elimination of Waste Ser.*, pp. 9, figs. 4).—This circular presents the report of a general conference of the farm equipment manufacturing industry and a simplified list of plow bolts proposed on that occasion by the National Association of Farm Equipment Manufacturers.

Principles of electric motors and control, G. Fox (*New York and London: McGraw-Hill Book Co., Inc.*, 1924, pp. XIV+499, figs. 298).—Information on the principles, performance, characteristics, and practical construction of electric motors and controllers is presented.

Hatching chicks electrically, H. E. BELL (*Jour. Elect.*, 53 (1924), No. 3, pp. 85-88, figs. 7).—In a contribution from the Oregon Agricultural College data on the operation of an electrically equipped incubating plant on the

Pacific coast having a capacity of 80,000 eggs are presented. The plant consists of a wooden building 44 ft. by 150 ft., which contains 131 incubators with a capacity of 612 eggs each. Double walls packed with sawdust for heat insulation are used, and the floor is covered with dirt and a layer of sawdust and shavings to reduce heat radiation. The building is heated by the incubators alone, and the temperature varies from 60 to 70° F. Each incubator is heated by 10 elements which are placed at the top of the incubator and spaced 7 in. apart, with 6 in. from the end elements to the end of the compartment.

Tests showed that the power in each individual machine was on for very short intervals of time only. The current in no machine remained on for more than a minute to a minute and a half, with the exception of the time necessary to reheat the eggs after cooling or turning, during which period the current remained on for an hour at a time. The power consumption was found to drop off on the fourteenth day due to the fact that the growth of the germ at this period begins to use the latent heat stored within the egg. The energy used during the first day was found to be relatively high on account of the initial heating of both the incubator chamber and the eggs. The daily consumption then remained constant at 4 kw. hours per day until the fourteenth day. From this time on until the chick was hatched, the consumption gradually fell off and dropped as low as 1 kw. hour per day with a room temperature of 65°.

Tests to determine the voltage regulation and the number of interruptions to service showed that the power went off on an average of once in every three days, but only once a season for a long enough period to require the starting of an emergency plant. The voltage had about the same characteristics from day to day, with a maximum of 122 volts and a minimum of 114 volts.

A third test showed that the temperature of the room affected the consumption of power materially. If the temperature of the incubator room was high, the amount of power used by the machines in operation was lowered. The three factors governing the proper maximum temperature for the room are considered to be the most satisfactory temperature for cooling the eggs, the temperature under which it is possible for men to work comfortably, and the temperature adapting itself to most efficient ventilation. Since the eggs must be cooled down to 98° several times during incubation, it has been found that the room temperature should not go above 95° in order to secure economy of time in the egg-cooling process, and an average of from 85 to 90° has been found to be the best.

Ventilation is said to be the most important factor. Experiments showed that when the temperature of the incubator room was raised to 85 or 90°, the ventilation in the type of incubator manufactured to-day becomes inefficient. It is stated that another feature of electric incubation upon which experimental study could be advantageously undertaken is that of the most desirable capacity of the heating elements.

Building the dairy barn, N. S. FISH (*Wisconsin Sta. Bul. 369 (1924)*, pp. 31, figs. 27).—Practical information on the construction of dairy barns, with special reference to the requirements of Wisconsin conditions, is presented, together with a number of working drawings.

Sewerage systems for farm homes, N. S. FISH, E. G. HASTINGS, and F. R. KING (*Wis. Agr. Col. Ext. Circ. 173 (1924)*, pp. 19, figs. 15).—Practical information on the planning and construction of sewerage systems for farm homes, with special reference to conditions in Wisconsin, is presented.

RURAL ECONOMICS AND SOCIOLOGY

A study of farm organization in central Kansas, W. E. GRIMES, J. A. HODGES, R. D. NICHOLS, and J. W. TAPP (*U. S. Dept. Agr. Bul. 1296 (1925), pp. 75, figs. 31*).—An intensive study of the organization and operation of 25 farms in McPherson County for the years 1920 to 1922, inclusive, was conducted cooperatively by the Bureau of Agricultural Economics, U. S. D. A., and the Kansas Experiment Station.

The average area of the farms included in 1922 was 295 acres, 245 of which were in crops and 42 in pasture. Wheat was the major crop, with corn the second, followed in rank by oats and alfalfa. Livestock raising was a minor part of the business. The labor and materials used in the several operations involved in the production of specific crops and of cattle, hogs, poultry, and work horses, and also the man and horse labor given to manure hauling, maintenance of machinery and real estate, hauling feed, garden work, preparing seed for seeding, and other miscellaneous duties, are set forth. The seasonal labor and tasks that may be interfered with or not by rain are classified, and suggestions are made as to the management of the labor program. The principles governing the choice of farm enterprises are discussed, and their application is illustrated by a suggested reorganization of a selected farm, representative in size and type of many McPherson County farms, and yielding approximately \$500 more in return for the farm resources. Under this plan the wheat acreage is reduced slightly, while that of feed crops is increased, adding alfalfa and Sudan grass. The numbers of milch cows, hogs, and chickens are increased, but the number of work horses is decreased. It is assumed that no radical changes would have taken place in wheat prices, yet an increased production of butterfat per cow and of eggs is counted upon.

Farm organization and cost of production on cotton farms in Anderson County, S. C., in 1922, W. C. JENSEN (*South Carolina Sta. Bul. 221 (1924), pp. 101, figs. 18; abs. in South Carolina Sta. Rpt. 1924, pp. 39-42*).—The survey reported upon here was planned with the purpose of determining the facts and principles involved in the organization and management of, and farming practices on, cotton farms in the Piedmont region of South Carolina. It included 333 farms and was conducted cooperatively by the Bureau of Agricultural Economics, U. S. D. A., and the station for the year 1922. The economic, social, and physical conditions of the region are described.

On the farms studied 52 per cent of the crop acreage was in cotton. Out of an average total of 68.2 acres, 17.8 were in corn, 8.8 in small grains, 3 in first crop hay, and 6 in second crop hay, principally cowpeas after grain. An average of 2 milch cows, 2 hogs, and 57 chickens were found per farm.

There were selected 120 farms of the entire number for the computation of costs of cotton, corn, oats, cowpea hay, and wheat and the cost of keeping mules. The more important factors that determine the yield and hence affect costs and profits were mule and man labor for cultivation, fertilizers, and damage by the boll weevil. Yields of less than 200 lbs. of cotton per acre cost about 7 cts. more a pound than higher ones. Man and mule labor costs were correlated to a considerable extent with the acre cost of cotton, but on a pound and total production basis heavy applications of these factors usually paid. The average yield of corn on the 120 farms was 16.5 bu., the average cost of production per bushel being \$1.45.

Analyzing the farm business as a unit, it was found that an average farm income of \$378 was obtained by the operators of the 333 farms included in the study. The owners made a higher farm income than the tenants. The average

labor income was —\$392, that for the tenants being \$227, while for the owners it averaged —\$502. The distribution of farm area to various purposes, the distribution of labor on entire farms, and the amount and kinds of fertilizer used are discussed, as are also the form of tenure, the amount of indebtedness, and the landlord's profits. The color and education of operators are considered to be important determining factors affecting farm income, being fixed ones, over which the operator has no control. Over tenure and size of business, however, he has more or less control, while others, such as yield, percentage of crop land in cotton, and efficiency in the use of work stock, are shown to be subject to human control in a given season. The relative profits of certain crops that may be grown subsidiary to cotton are briefly set forth, and certain broad economic and social applications are made of the results obtained by the study.

Organization and management of typical West Virginia farms, A. J. DADISMAN (*West Virginia Sta. Bul.* 187 (1924), pp. 75, figs. 26).—Surveys were made in 1914 in four regions of the State which were deemed representative of typical conditions, taking 544 complete farm management records. Studies based on data taken in two of the regions have been noted (*E. S. R.*, 35, p. 90; 43, p. 92). In this one the distribution of capital, number and value of farm animals, crop acreage and yields, and farm receipts, expenses, and earnings are shown for general farms operated by owners and by tenants and livestock, dairy, and truck farms, including the farms surveyed in the four sections. From 201 farms in Brooke County 22, and from 74 in Preston County 20, farms surveyed in the summer of 1914 were selected for a 5-year study. The changes in the farm business on these farms from 1913 to 1917, inclusive, with the 5-year averages, are tabulated, illustrated, and discussed.

About 25 records were obtained by personal visits to farmers during the summers of 1915 and 1923 with respect to the total cost of producing corn, oats, wheat, buckwheat, and potatoes for the previous years in Preston and Brooke Counties. These are shown, and the distribution of man and horse labor on these crops in Preston County is presented graphically. The publication is concluded with a discussion of the relative importance of certain factors in farm organization.

Landlords of Nebraska farms, J. O. RANKIN (*Nebraska Sta. Bul.* 202 (1924), pp. 38, figs. 4).—A survey previously noted (*E. S. R.*, 49, p. 189) supplied the data discussed here. Information was secured with reference to 654 landlords, 495 of whom owned full tenant farms, while 159 owned only the rented portions of the part-owner farms. Nearly half of these landlords owned two or more farms apiece.

A comparison is made between returns from the 1900 census with those from this survey. A marked contrast is noted between the number of one-farm owners in 1920 in the region surveyed and in the United States as a whole in 1900 as revealed by the census. In the latter case 80 per cent owned only one farm apiece.

Practically one-half of this discussion deals with the business relations of landlords and their tenants, setting forth terms of leases, what each contributes; the percentage of the personal property furnished by landlords and tenants; the compensation, supervision of farms, and work done by landlords; and the landlord's share, giving particularly his share of the corn, wheat, oats, and barley, and alfalfa and other hay crops.

Economic studies of dairy farming in New York.—II, Grade A milk with and without cash crops, E. G. MISNER (*New York Cornell Sta. Bul.* 433 (1924), pp. 147, figs. 19).—This bulletin continues work previously noted

(E. S. R., 50, p. 89). The history of the production of grade A milk in New York State is set forth, and a detailed report is made covering 135 farms, 84 of which were in Chenango County, in the vicinity of Oxford and Brisben, and delivered milk to the plants of a single company in these two villages. These farms comprised the group without cash crops. The remaining 51 farms were in the vicinity of Homer, Cortland County, and Tully, Onondaga County, delivering milk to incorporated dairies in the villages named. These farms comprised the group with cash crops.

Of the 84 Oxford operators 66 were owners, 13 were share tenants, and 3 were cash tenants, while of the second group 38 were owners and 10 were share tenants. The common method of leasing is under a half-and-half share agreement, with the landlords usually furnishing more than half the cattle. The average value of the 135 operators' time was \$956 for 12 months. The following table summarizes some of the data presented:

Cost of milk production on New York farms, 1921-22

Item	Oxford	Tully and Homer
Number of farms.....	84	51
Average size.....acres.....	194	168
Average crop area.....do.....	64	75
Average total capital.....	\$13,040	\$19,204
Average value per acre.....	46	81
Total receipts.....	4,161	7,018
Current operating expenses.....	2,828	3,997
Expense for new buildings.....	66	508
Expense for livestock purchased.....	316	488
Farm income.....	951	2,025
Labor income.....	299	1,065
Net cost of production of 100 lbs. of milk.....	2.59	2.79
Net cost per pound of butterfat.....	.72	.80
Average loss per cow.....	9.04	10.73
Decrease in market value per cow.....	26.43	23.02
Loss per 100 lbs. of milk produced.....	.17	.18
Return per hour after all charges except for labor were made.....	.20	.24

The cost of raising heifers, the question of fall or spring freshening, and the several combinations of enterprises with dairying are discussed to bring out their advantages and disadvantages. Of the Tully and Homer farms those adding cows entirely by purchase were larger. They obtained 827 lbs. more milk per cow at the same cost per 100 lbs. and had a labor income of \$1,108 more per farm than those farms that added cows exclusively by raising. Of the Oxford farms, 14 replaced cows entirely by purchase, and their average labor income was \$247, while 44 replaced entirely by raising and had an average labor income of \$430. On the 135 grade A farms there were only five flocks of 200 fowls at the end of the year. The leading cash crops on the Tully and Homer farms were potatoes, cabbage, hay, and factory peas.

The variations in the size of the business, rates of production, kinds and amounts of fertilizer used, the distribution of labor, and cropping systems and rotations are brought out, and the averages for the two groups of farms are tabulated and compared. Finally, the important business factors for four of the most successful farms with cash crops are given, and copies of the record forms that were used for the survey are appended.

The cost of producing milk and some factors influencing the cost, E. G. MISNER (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 1097-1111*).—Data showing the feed and labor cost of milk production are summarized from long continuous records in reports and bulletins of the ex-

periment stations. An analysis is made also to show the features of the organization of the dairy enterprise or methods of feeding and handling which influence cost. These are taken to be the size of the business, the size and age of the cow, the time of freshening, feeding practices, and the value of offspring. A bibliography of 25 titles on the subject of milk production costs is included.

Work of children on truck and small-fruit farms in southern New Jersey (*U. S. Dept. Labor, Children's Bur. Pub. 132 (1924), pp. V+58, pls. 3*).—The study upon which this report is made was conducted in Cumberland, Gloucester, and Burlington Counties in southern New Jersey. Detailed information as to the nature and extent of work on truck farms was obtained for every child under 16 years of age who had worked in the fields at least 12 days during the year previous to September, 1921. General information was secured from school authorities and other local officials, and an inquiry was made into the methods of recruiting migratory labor in Philadelphia.

In the 243 local families interviewed there were 445 children who had worked on truck farms during the preceding year, 345 of whom lived on farms and 100 of whom came from nearby settlements. The workers ranged in age from 5 to 15 years, 76 per cent of the group being under 14, and 20 per cent younger than 10 years of age. They were found to have done general farm work, planting and transplanting, and harvesting. Of the total number reporting hours worked in the field, 22.8 per cent spent 6 hours and less than 8 hours on a typical day, 16.4 per cent were found in each of the groups of less than 4 hours and 4 hours and less than 6, while 15.1 per cent spent 10 hours and less than 11 in the field. Half of the working children had received wages. Of 69 children from 12 to 15 years of age who reported their earnings, almost half had made 15 cts. an hour or more, 6 of them having received 25 cts. or more. A large majority of the 377 working children whose school records showed that they had been absent during the school year preceding the survey had lost from several days to four months on account of farm work.

More than half of the children working on the truck and fruit farms of the areas included in the survey were included in the families of migratory workers. Of their number 79 per cent were under 14 years of age, and 21 per cent were under 10. The work of children in these migratory families was less varied than that of the local workers, and the city children worked on the whole longer hours than the local workers. Although all except 14 of the 186 children who could tell the exact amount earned on the day preceding the agent's visit were 10 years of age or over, 81 per cent had earned less than 15 cts. an hour and 46 per cent less than 10 cts. School records obtained from 294 children indicated that three-fourths of them had been present less than 80 per cent, and a little over one-fourth had attended a little less than 60 per cent of the school term. The schools attended by the children were in session from 181 to 194 days.

Attendance and scholarship records were obtained for 1,298 children in Philadelphia who had left school in the spring of 1921 because their families had moved to the country, and these data are set forth and discussed in detail. The houses for these migratory workers are also described.

The function of the local bank in financing the farmer, E. B. HARSHAW (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 207-223*).—A discussion of marketing programs for cooperative organizations in the United States and of the legislation providing long-time, intermediate, and short-time credit to farmers.

Economic and social factors in price conciliation in the milk industry, C. L. KING (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923,*

vol. 2, pp. 869-875).—Fourteen forces that bring about a demand for the machinery of price conciliation and arbitration in the milk industry are analyzed, being grouped according as they may be advantages of collective bargaining to producers, milk buyers and distributors, or the consumer.

Development and present status of farmers' cooperative business organizations, R. H. ELSWORTH (*U. S. Dept. Agr. Bul. 1302 (1924), pp. 76, figs. 37*).—The data, classified and tabulated, comprising the major portion of this report were obtained by survey in 1922 and by subsequent follow-up work until in March, 1924, information had been gathered with reference to 10,160 active cooperative buying and selling organizations. The first survey study in a series of which this is the third was made in 1915 and has been noted (*E. S. R.*, 37, p. 888). Data obtained in a second study in 1919 are briefly summarized and incorporated in two tables in this publication. The latest returns are presented graphically and summarized for years and periods of years, in some cases beginning with 1900, in 95 tables pertaining to the associations in the United States and in leading States; organization characteristics and membership; amount of business; date of organization; collective purchasing; grain marketing associations; creameries, 1922 and 1923; fruit and vegetable associations; associations handling livestock; cotton, rice, tobacco, and wool associations; agricultural consumer cooperation; associations "out of business"; and specific associations.

Cooperation as a factor in stabilizing the market for agricultural products, S. I. MILLER, JR. (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 252-256*).—Cooperation is held first to standardize the quality of the product and develop brands and good will throughout the marketing world; second, to standardize quantity; third, to create a better spread of the product upon the existing market; and fourth, to develop and expand the market for the product coming within the cooperative endeavor.

Status of trade associations in the dairy industry from the standpoint of economics, R. E. LITTLE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 256-265*).—The history of the guild movement is briefly outlined. The trade association of to-day is defined, and its activities are outlined as including industrial and commercial research, market expansion, legislative activities, the study of transportation problems, credit and insurance protective work, the prevention of trade abuses, simplification and standardization, publicity, the initiation of policies of employee relations, and mediation in Government relations. Trade associations complement the corporations, and while they do not manufacture nor do they distribute or sell, their aim is to facilitate these and other commercial or governmental processes. A brief bibliography is appended.

Marketing dairy products: Creameries and cooperative cream shipping stations in North Dakota, A. H. BENTON (*North Dakota Sta. Bul. 182 (1924), pp. 40, figs. 19*).—Records are said to show that at least 145 local creameries have been established in North Dakota. Thirty-eight were in operation in 1923, all but 4 of these being engaged in the manufacture of butter. The bulk of the cream in North Dakota is purchased by centralizer creameries, of which there are 14 located in the State. Between 25 and 30 others shipped cream to their plants in neighboring States. In 1923 there were 1,235 cream stations, 1,209 of which were operated by centralizer creameries and independent cream buyers and 26 by cooperative cream shipping associations. One-third of these have been very successful. The average value of equipment of the cooperative stations was \$452, and the average operating expense \$1,822. The

successful ones handled an average of 76,527 lbs. of butterfat and had an average of 105 members. Legal and business forms are suggested for use in the organization and operation of these stations.

The cooperative marketing movement, A. SAPIRO (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 100-107*).—A discussion is given of the so-called commodity plan of cooperative marketing as applied to the marketing of milk in the United States. The proper aim of milk market organization is held to be to develop and stabilize the market for milk and milk products and to use the legitimate dealer to his own profit in the process.

Cooperative marketing of milk (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 83-86, 695-743*).—The following papers were presented at a session of the congress devoted to this subject: Cooperative Dairying, by R. M. Owen; Work of the National Farmers' Union in Connection with Milk Organization in England, by E. W. Langford; Review of Progress in Fluid-milk Marketing in the United States, by C. W. Holman; Types of Collective Bargaining Organizations, by R. Pattee; The Dairymen's League, by J. D. Miller; Milk Collection, Treatment, and Distribution in the Industrial Cooperative Movement of England, by A. Park; The Cooperative Milk Plant in the Small City, by L. B. Cook; Cooperation as Applied to the Dairy Industry in England, by F. D. Acland; and Cooperative Milk Distribution, by H. Hartke. A paper entitled Cooperative Marketing of Milk, by J. D. Miller (pp. 83-86), was given in a session on the development of dairying in the United States.

Cooperative marketing of manufactured products (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 889-945, fig. 1*).—The papers read at this session of the World's Dairy Congress are concerned with the particular problems of marketing dairy products in certain regions. Among them are Danish Cooperative Dairy Organizations and Their Works, by S. Sørensen; A Central Cooperative Organization for the Marketing of Butter, by J. Brandt; The Cooperative Marketing of Butter on the Pacific Coast, by C. L. Mitchell; Building a Cheese Industry in New Territory, by V. D. Chappell; Cooperative Manufacturing and Marketing of Dairy Products, by J. A. Scollard; Systems of Dairy Farming in Scotland and the Development of Cooperative Organization in Dairying, by J. Drysdale; The Methods That Have Been Used by the Cooperative Marketing Association in Holland, and the Results That Have Been Obtained, by R. M. Veeman; Cooperative Creameries in Ireland; Cooperative Creameries in the Mississippi Valley, by O. A. Storvick; and Cooperative Marketing of Cheese by Producers: Its Difficulties and Advantages, by T. Macklin.

Fundamental aspects of dairy marketing, L. D. H. WELD (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 77-82*).—Marketing functions and the system by which they are performed by middlemen are briefly outlined, and the particular problems in the marketing of butter, milk, and cheese are noted. It is pointed out that butter is marketed on a very narrow margin of cost, while milk distribution and to a lesser degree that of cheese are relatively very expensive.

The cooperative advertising of dairy products, P. F. O'KEEFE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 2, pp. 945-949*).—Numerous instances of the economic effectiveness of cooperative advertising by producers of agricultural products in the United States are cited.

The marketing and distribution of American-grown Bermuda onions, W. M. STEVENS (*U. S. Dept. Agr. Bul. 1283 (1925), pp. 56, figs. 14*).—The principal onion-growing regions of the United States are defined, methods of distribution are described, and important factors which affect Bermuda onion

prices are pointed out. They are said to be characterized by wide fluctuation, both within each season and as between one season and another. A remarkably close correlation is shown to exist between the quantity of old onions in storage February 1 and the opening price. The size of the new crop exerts only a moderate influence on the price level at which the new crop will sell. The rate of shipments, however, affects the price during the season considerably. Most of the factors affecting prices are said to be beyond the control of the individual grower and can be met only by organized united effort. Recommended United States grades for Bermuda onions are given.

The market for American agricultural products in the United Kingdom, G. B. L. ARNER (*Jour. Farm Econ.*, 6 (1924), No. 3, pp. 283-294).—This is a discussion of changes in economic conditions affecting demand in the United Kingdom, changes in the condition of supply in the United States, and the competition of other countries, and of the way in which these factors apply in the cases of commodities such as cotton, wheat and flour, pork products, tobacco, and minor ones. It is held to be reasonable to expect that in the future the United Kingdom will continue to import from the United States cotton in decreased volume, tobacco in constant or perhaps increasing volume, pork products as long as the price remains low and in reduced quantities at higher prices, wheat and flour in small quantities varying with the degree of competition from Canada and Argentina, feedstuffs in considerable quantities only in years of crop shortage in competing countries, fresh fruits in fairly constant but relatively small quantities, dried fruits in fair volume depending on the price and the future growth of competition, and glucose and perhaps other specialized grain products in the same volume as in the past with little competition.

International trade in dairy products: Significant trends of supply, demand, and price, H. C. TAYLOR (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.*, 1923, vol. 1, pp. 55-62).—Sources of surplus dairy products are said to have shifted from the countries of the Northern to those of the Southern Hemisphere, and as a result of this shift the seasonal trend of butter imports into Great Britain is such as to tend toward a uniform supply throughout the year. From the point of view of the United States, this recent far-reaching change in seasonal supply and price serves to concentrate attention upon the possibility that mutually advantageous seasonal trade in fresh butter may eventually replace, to some degree, the system of seasonal storage that is developing here. The dairy interests of Denmark, Russia, Germany, New Zealand, Canada, and the Netherlands are touched upon briefly.

Some aspects of the international trade in dairy produce, J. A. RUDDICK (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc.*, 1923, vol. 1, pp. 20-26).—This paper is confined largely to an analysis of the imports of butter and cheese into the United Kingdom, the principal international market for dairy products. A rapid increase in exports from New Zealand since about 1883 and a remarkable development in exports from the Southern Hemisphere in general since 1903 are pointed out. Certain tropical and subtropical regions are thought to offer a possibility for future expansion of dairying, the establishment of the creamery industry on the Fiji Islands being noted in this connection. It is considered unlikely that the industry will expand to any great extent in those countries where it has been extensively developed. The importance of the Baltic States in the future is emphasized.

Monthly Supplement to Crops and Markets, [December, 1924] (*U. S. Dept. Agr., Crops and Markets*, 1 (1924), Sup. 12, pp. 393-448, figs. 6).—Statistics representing estimates of the harvested acreage, production, yield, value,

and price of important crops for the years 1922 to 1924, inclusive, are tabulated by States. Statistics of truck crops for shipment and for canning or manufacture are tabulated for 1921-1924. The usual estimated farm prices of important products are shown for November 15, 1924, with comparisons, and monthly average farm prices of specific commodities are given. A review of the price situation is presented with tabulated index numbers of farm prices and wholesale prices of nonagricultural commodities through a period of years. The percentage of the corn crop maturing is set forth graphically and statistically, with a brief discussion.

Crops and Markets, [December, 1924] (*U. S. Dept. Agr., Crops and Markets*, 2 (1924), Nos. 23, pp. 353-368; 24, pp. 369-384; 25, pp. 385-400, fig. 1; 26, pp. 401-416).—Current weekly abstracts of market reports and reviews of the market situation through the month are presented, with reference to important agricultural commodities, and detailed data are tabulated. Brief notes are also given covering the condition of foreign crops and the foreign market situation.

Corn and hog correlations, S. WRIGHT (*U. S. Dept. Agr. Bul. 1300* (1925), pp. 60, figs. 30).—The present study was made in order to discover what relations existed during a period of normal conditions from 1871 to 1915 between pork production and prices and the corn situation. The factors considered with respect to corn are acreage and yield per acre and the average farm price. With respect to hogs the slaughter at large markets, the average weight, the pork production, the average market price, and the farm price have been found. In all but the last of these items the data from the eastern and from the western pack have been considered separately. All the possible correlations among these variables have been calculated. In an attempt to find the system of causal relations that would account for the observed correlations, path coefficients have been calculated for each path of influence in this system, from which the expected value of each of the 510 correlations has been found (pp. 45-50). A series of formulas is given for predicting the fluctuations of each variable, with discussions of limitations. The following conclusions are reached:

The dominating features of the hog situation are certain effects of the corn crop and price and an innate tendency to fall into a cycle of successive overproduction and underproduction, two years from one extreme to the other. The amount of breeding at a given time is determined largely by the profits from hog raising during the preceding year, which depends on the ratio between the price the packers pay for the hogs and the price of corn during the period in which they were raised and finished. The peak effect on breeding occurs from half a year to a year after the hog-corn price ratio has reached its peak and begun to decline. Breeding, however, does not reach its low point until some time after the hog-corn price ratio has begun to rise. The interactions among the corn and hog prices and hog breeding, around which the whole hog situation centers, are given in detail. The summer live weight is for various reasons a remarkably close indicator of the amount of breeding for the period from the preceding through the following fall. It shows higher correlations on the whole with other hog variables than any other variable dealt with, although the least affected by corn prices. Winter live weight, on the contrary, is determined largely by the preceding corn crop and only secondarily by the amount of breeding during the preceding year.

Seasonal slaughter is determined in part by the amount of breeding during at least three years preceding and in part by a tendency toward concentration in the summer season, in which prices are high, at the expense of the winter,

whenever the corn supply permits. The corn crop has its maximum effect on slaughter in the following summer. Pork production depends very much more on the fluctuations in slaughter than on the relatively small percentage fluctuations in weight. The eastern pack runs parallel to the western in most respects. The influence of corn crop and prices is considerably less. Western hog prices, on the other hand, are even more closely correlated with the eastern than with the western pack, probably owing to their influence on eastern shipments. The farm price of hogs is very closely correlated with the packers' price but seems to lag behind several months.

Agriculture and dairying in the world's economic equilibrium, B. M. ANDERSON, JR. (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 34-41*).—While the loss of European markets for food and raw materials at the same time that producing capacity was unimpaired adversely affected American agriculture through the wheat surplus, the author believes that American dairy interests are very largely emancipated from dependence on the international market. There appears to be ample opportunity for further consumption at home, although labor is the limiting factor. Certain difficulties in determining the comparative importance of dairying and other branches of agriculture are pointed out

The collection and distribution of milk and dairy products statistics by the International Institute of Agriculture at Rome, C. LONGOBARDI (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 45-55*).—The plans and efforts of the International Institute of Agriculture in organizing statistics of milk and dairy production are briefly described, with notes as to the available statistical material in certain countries. It is held necessary for every country to possess annual figures for the number of milch cows, and desirable to concentrate chiefly on efforts to secure the establishment of annual statistics of milk production in the different countries.

AGRICULTURAL EDUCATION

Research and education in agriculture, including dairying, in the United States, A. C. TRUE (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 86-100*).—This is a brief presentation of the general system of agricultural education and research in the United States, particularly in its application to dairying, and discusses agencies for research, higher education, extension work, and secondary education.

Instruction in dairying in educational institutions (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 587-593, 603-659*).—Among the papers read before this session of the congress were The Education of Farmers and Dairymen in Switzerland [trans. title], by A. Peter; Vocational Instruction in Dairying in Secondary Schools, by J. R. Dice; Methods of Teaching Dairying to College Students, by H. H. Dean; Collegiate Instruction in Dairying, by W. A. Stocking; Graduate Instruction in Dairy Husbandry, by C. H. Eckles; The Status of Dairy Education in England and Wales, by V. E. Wilkins; Dairy Instruction in Austria, by W. Winkler; Dairy Instruction in Norway, by K. Støren; Instruction in Dairy Science in the Agricultural College at Wageningen, by B. van der Burg; Dairy Instruction in Sweden, by L. F. Rosengren; The Dairy Industry of Denmark: Education as the True Foundation, by N. K. Jensen; Dairy Instruction in the Netherlands, by K. H. M. van der Zande; Cheese-making Instruction in Italy [trans. title], by G. Fascetti; and Short-course Instruction in the Manufacture of Dairy Products, by E. H. Farrington.

Extension methods in dairy education (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 343-352, 366-381, 400-419*).—Among the papers read at this session of the World's Dairy Congress are Agricultural Extension Methods and Activities, by A. A. Borland; Methods Adopted in England and Wales to Convey Dairy Education and the Principles of Cooperation to the Farmer, by J. F. Blackshaw; The Work of a County Dairy Instructress in England and Wales, by D. G. Saker; and Dairy Instruction Given by the Cooperative Dairy Organizations in the Netherlands, by J. A. Geluk. The proceedings of an informal conference on extension methods are included.

Motion pictures and dairy education, R. W. BALDERSTON (*U. S. Dept. Agr., Dairy Div., World's Dairy Cong. Proc., 1923, vol. 1, pp. 537-541*).—The organizations providing them and some of the films available dealing with dairying and dairy education are briefly noted.

An extension program in crop production to reenforce range livestock, dairying, and human nutrition for the Western States, W. A. LLOYD (*U. S. Dept. Agr., Dept. Circ. 335 (1924), pp. 16*).—Reports of the committees on range livestock, dairying, human nutrition, and farm crops are incorporated into the report of the coordinating committee appointed to go over the material presented at the Western States extension conference, held at Tucson, Ariz., November 3-8, 1924.

Agricultural education in Cornwall, W. BORLASE (*Jour. Min. Agr. [Gt. Brit.], 31 (1924), No. 5, pp. 442-452*).—This account covers briefly evening classes in agriculture, other educational activities, and technical instruction in dairying, horticulture, and poultry management.

Day courses in agriculture for countrywomen, E. H. PRATT (*Jour. Min. Agr. [Gt. Brit.], 31 (1924), No. 8, pp. 757-763*).—A syllabus in use in a series of day classes for farmers' daughters conducted in Derbyshire, England, is reproduced.

The teaching plan and the organization of subject matter in the agricultural schools under the direction of the chamber of agriculture for the Rhine Province [trans. title] (*Veröffentl. Landw. Kammer Rheinprov., No. 2 (1924), pp. 53*).—A new schedule of courses in agriculture and horticulture and an outline of the subject matter to be presented are given here.

Outlines of course of instruction in agricultural nature study for the rural schools of California, O. J. KERN (*California Sta. [Pamphlet], rev., 1924, pp. 100, figs. 60*).—This is a revised edition of a teaching outline previously noted (*E. S. R., 49, p. 195*).

Junior project work in agriculture, H. E. GAYMAN (*Jour. Rural Ed., 4 (1924), No. 3, pp. 97-105*).—The program of junior agricultural project work in Pennsylvania is set forth in detail.

The health of rural school children, A. D. MUELLER (*Jour. Rural Ed., 4 (1924), No. 3, pp. 106-113*).—Several instances of rural health services in various sections of the United States are described.

The field of research in the economics of the home, H. KNEELAND (*Jour. Home Econ., 17 (1925), No. 1, pp. 15-19*).—The truly economic problems of the home are thought to include the utilization of wealth in the home, as well as the production and distribution of it there. The author holds it to be essential that students analyze data with reference to family expenditures to determine causal relationships and formulate generalizations from them, thereby, perhaps, discovering to what extent family expenditures are influenced by advertising and salesmanship on the part of the producer seeking profits and to what extent by traditional standards of consumption. Evaluation of possible methods of providing the population with the essential housekeeping services

is deemed necessary. Other specific problems center about the economic relationships within the family; the part of the home maker in the control of family income, expenditures, and property; and the relative needs of various members of the family in the way of food, clothing, and other items.

Agricultural mechanics, R. H. SMITH (*Philadelphia and London: J. B. Lippincott Co., 1925, pp. VII+357, figs. 366*).—This book presents a course of instruction in farm mechanics intended to prepare the average farmer to make his own minor necessary repairs. The material is organized to be presented by the project method, the exercises including the construction of devices for use in the farm shop, the dairy, the poultry house, and other departments of the farm.

Economic geography, R. H. WHITBECK and V. C. FINCH (*New York and London: McGraw-Hill Book Co., Inc., 1924, pp. X+558, figs. 331*).—This book emphasizes especially the economic adjustment of peoples to their geographic environment. It is divided into two parts. Chapters 1 to 18, inclusive, treat of the United States and Canada, since these two countries are subject to similar geographical influences. The second part of the book, including chapters 19 to 36, deals with foreign countries.

MISCELLANEOUS

Report of the Alaska Agricultural Experiment Stations, 1923, C. C. GEORGESON (*Alaska Stas. Rpt. 1923, pp. [2]+37, figs. 24*).—This contains the organization list and a report of the several lines of work carried on during the fiscal year ended June 30, 1923. Meteorological data and accounts of the extensive tests with field and garden crops are abstracted elsewhere in this issue.

Thirty-second Annual Report of [Minnesota Station, 1924], W. C. COFFEY (*Minnesota Sta. Rpt. 1924, pt. 1, pp. 38*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1924, and a report by the director dealing with changes in staff, publications, and the classification of the station projects.

Forty-third Annual Report of the New York State Agricultural Experiment Station, [1924], R. W. THATCHER (*New York State Sta. Rpt. 1924, pp. 56*).—This contains the organization list, a review of the work and publications of the station, and a financial statement for the fiscal year ended June 30, 1924. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-seventh Annual Report of the South Carolina Experiment Station, [1924], H. W. BARRE (*South Carolina Sta. Rpt. 1924, pp. 95, figs. 30*).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1924, and a report of the work and publications of the station during the year. The experimental features reported are for the most part abstracted elsewhere in this issue.

Thirty-sixth Annual Report of [Tennessee Station], 1923, C. A. MOOERS ET AL. (*Tennessee Sta. Rpt. 1923, pp. 31, fig. 1*).—This contains the organization list, a report of the director and heads of departments, and a financial statement for the fiscal year ended June 30, 1923. The experimental work is for the most part abstracted elsewhere in this issue.

Bi-monthly Bulletin [of Western Washington Station, January, 1925] (*Western Washington Sta. Bimo. Bul., 12 (1925), No. 5, pp. 97-124, figs. 7*).—In addition to articles abstracted elsewhere in this issue, this number contains brief articles entitled Cow Pox, by J. W. Kalkus; Pruning Ornamental Plants, by H. D. Locklin; and Spraying Trees and Bushes, by A. Frank.

NOTES

California University and Station.—A range of 10 greenhouses each 30 by 80 ft. is under construction. These houses will be divided among 11 departments of the College of Agriculture with the larger amount of space allotted to pomology, plant nutrition, landscape gardening, and genetics. When completed the present conservatory will be torn down, the entire equipment of the college then being on the agricultural campus. Funds for the work were supplied in part by the State and in part by private subscriptions in Oakland, Berkeley, and San Francisco. Ultimately a series of five head houses will be added.

A stationary spray plant is to be installed on the university farm, the orchards being piped with mains connected with the stationary pumping plant. This system will permit of quick spraying at critical times for pest control, even though the land is too wet to be crossed by a spray rig.

Indiana Station.—Edward G. Proulx, State chemist and seed commissioner, died March 31 after an illness of over two years. He was born in Hatfield, Mass., December 3, 1880, graduating from Massachusetts Agricultural College in 1903, and receiving the M. S. degree from Purdue University in 1909. He served in the Massachusetts Station as assistant chemist from 1903 until 1907 and subsequently at Purdue, becoming State chemist in 1917 and State seed commissioner in 1921. He was president of the Association of Official Seed Analysts of North America in 1924.

Kansas College.—The short course in beef cattle herdsman'ship referred to in the January issue (E. S. R., 52, p. 99) was the fourth to be offered by the college, the first having been given in 1921. The college was in no way responsible for the erroneous implications in the note as originally printed.

Massachusetts College and Station.—A series of radio talks on poultry husbandry was followed by applications from 738 radio listeners for the supplements on poultry raising issued by the college in connection with the course, and the questions sent out were answered regularly by 150 persons. It is stated that some of the best replies were received from students in the Perkins Institute for the Blind.

Harlan N. Worthley, investigator in entomology in the station, resigned March 1 to accept a position as extension entomologist in the Pennsylvania College.

Cornell University.—The legislature has constituted the school of home economics of the College of Agriculture as the New York State College of Home Economics, coordinate with the other colleges of the university and administered in a way comparable with the New York State College of Agriculture and the New York State Veterinary College. The new college will, however, continue to utilize the same officers of administration for extension work, library facilities, and bookkeeping as the College of Agriculture.

The College of Home Economics has a staff of 7 professors, 11 assistant professors, 6 instructors, 2 assistants, 5 administrative officers, 8 administrative extension officers, and 2 junior extension specialists, together with a clerical staff and a student enrollment of 554. A research laboratory in human nutrition has recently been established.

New York State Station.—The 1925 Legislature made the following appropriations for the station: Personal services \$190,050, maintenance and opera-

tion \$55,175, special items \$35,300, and new construction \$3 500, making a total of \$284,025. Among the special items is a provision for \$5,500 for investigations relating to canning crops. Three new positions have been created, one in entomology, one in plant pathology, and one in vegetable gardening. Appointments to these positions will be made July 1, when the measure goes into effect, and the three appointees will make their headquarters at Geneva. A farm of about 60 acres will be leased in the vicinity of the station, where investigations will be made under field conditions.

Dr. U. P. Hedrick, horticulturist, has been made a member of the advisory board of the Russian Reconstruction Farms, Inc., described as "a philanthropic and humanitarian organization to prevent future famines by educating Russian peasants in modern American farming methods."

Ohio State University.—The new agricultural engineering building has been named Ives Hall in honor of the late F. W. Ives, whose death in July, 1924, has been noted (E. S. R., 51, p. 300). The building will cost \$127,000, and two wings will be erected subsequently at an additional cost of \$73,000. It is expected that machinery valued at approximately \$100,000 will be lent by the different implement companies.

Utah Station.—The legislature has appropriated funds for establishing two new experimental farms, one to be located in San Juan County and the other in Uintah County. These farms will be for the purpose of carrying on experimental work in the growing of alfalfa seed.

Necrology.—Dr. Charles D. Woods, director of the Maine Experiment Station from 1896 to 1920, died at West Newton, Mass., on March 30.

Doctor Woods was a native of Maine, being born at Brooks September 11, 1856. He was graduated at Wesleyan University in 1880 and served as assistant in chemistry there until 1883. After a period of five years as teacher in science at Wilbraham Academy in Massachusetts, he became chemist and vice director of the Connecticut Storrs Station, holding this position until his appointment in 1896 as professor of agriculture in the University of Maine and director of the Maine Station. In 1921 he became consultant in agriculture for the War Department, and since 1922 he had been director of information in the Massachusetts Department of Agriculture.

Doctor Woods made notable contributions to the subjects of acquisition of atmospheric nitrogen by plants, the effect of fertilizers on the composition of corn, methods of field sampling of crops for analysis, and the improvement of the bomb calorimeter. He was also one of the pioneer station workers in human nutrition, serving as an expert of the U. S. Department of Agriculture from 1894 to 1908. This work included cooperative investigations of wheat flour and various other foods, dietary studies, food analyses, digestion experiments, and the like, and he was the author of numerous publications dealing with these matters.

For many years he was a leading figure in the Association of American Agricultural Colleges and Experiment Stations, serving in various capacities but notably as a member of the committee on experiment station organization and policy from its creation in 1905 until his retirement from station work in 1920. He was intensely interested in the promotion of research, and he labored earnestly and consistently to raise the standards and ideals and strengthen the status of the stations as research institutions. He conceived the function of the station director to be fundamentally that of providing conditions congenial to effective research, and he endeavored to realize this ideal for his own staff of workers so far as possible. Under his leadership the Maine Station made marked progress despite restricted resources and other handicaps, and by its success his own career can perhaps be most adequately evaluated.

EXPERIMENT STATION RECORD

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The conference on the Purnell Act, held at St. Louis April 20 and 21, was a remarkable gathering, well conceived, enthusiastic, and fruitful. It brought together, at a time when plans were being made and policies initiated, most of the people immediately interested in the administration of the new act, for a period of counsel and conference. It helped to clear the way for constructive and effective action when the act goes into operation July 1, and it reduced to a minimum the lost motion and uncertainty and any working at cross-purposes which might have attended a beginning without the benefit of such a meeting of minds.

Although the Purnell Act, like its predecessors, provides for the appropriation of funds to each State as an independent unit, the idea of experiment station solidarity has become so firmly established with the passing of the years as to lead almost instinctively to group conference and action. This means that the stations, despite the absence of organic connection, are no longer isolated institutions but units in a great country-wide system of research, with many things in common and in which, without sacrifice of individuality or autonomy, the interests of the group as a whole receive large consideration.

The St. Louis conference was arranged by the Association of Land-Grant Colleges as a special meeting of presidents and station directors. Its purpose was to consider not only the opportunities under the new act for enlarging the scope of investigation at the stations but also the obligations which it imposes and the means of meeting these in the most effective way. Attendance was obviously voluntary, and it is most gratifying that, although the meeting was injected into the midst of a busy college year, every State was represented. For the 48 stations, 43 directors and 3 vice directors were present, as well as 22 college presidents. The Federal Department of Agriculture was represented by its Secretary, the Chief of the Office of Experiment Stations, and officers of several bureaus immediately concerned. Interest in the sessions was keen and participation in the discussions abundant and informative.

In a comprehensive review of the situation, the Secretary of Agriculture spoke of the gathering as a "time for counsel and for mutual understanding, a close working together for common ends." He pointed out that the Purnell Act affords an exceptional opportunity for service, as it is the "strongest testimony of confidence in the power of organized agricultural research that this or any other government has ever expressed," but that it carries with it grave responsibilities in which both the stations and the department will share, and in which the need for close cooperation and coordination of effort has become outstanding.

Secretary Jardine went on to set forth the objects of the legislation, outlining ideals for investigation under it, and suggesting specific lines in which the field of inquiry might be profitably enlarged. The point was made clear that the act is designed to give further aid to a going concern, that it is "for the more complete endowment and maintenance of agricultural experiment stations now established," each with an existing organization, administrative machinery, and in large measure the buildings, land, and other basic facilities for research. This would imply that, as President Pearson of the executive committee and several others indicated, the new appropriations ought not to add materially to the general overhead expenses of the stations, but that they will be almost wholly available, as the act prescribes, for "paying the necessary expenses of conducting investigations or making experiments . . . and for printing and disseminating the results of said research."

Another fundamental principle laid down by the Secretary was that the fund should be used primarily for investigations of substantial character. The act "is a fact-finding, fact-interpreting measure. Tested methods of research should be applied to investigations which will yield the most useful results. Every effort should be made to avoid a type of superficial investigation which now has been outgrown. Problems of fundamental importance should be attacked by adequate methods and with full knowledge of other investigations in order to avoid wasteful duplication. In other words, what is most needed is thoroughly constructive work. The new fund is not for the exploitation of what is known or for speculation based on personal opinion or inadequate data, but it is for sound investigation in the best sense, calling for men and women with breadth and penetration of vision and of demonstrated ability in the research field."

As regards subject matter, considerable emphasis was naturally laid on agricultural economics, home economics, and rural sociology. The large prominence which was accorded these questions was to have been expected under the circumstances. Unlike the Hatch and

Adams Acts, the Purnell Act makes specific provision for studies of the distribution and marketing of agricultural products and for "such economic and sociological investigations as have for their purpose the development and improvement of the rural home," thus making possible the bringing to bear of attack by organized research on a wide range of comparatively new but very important problems. To a considerable extent the passage of the act was undoubtedly facilitated by the special need which was being felt for a comprehensive and unbiased study of these questions. Secretary Jardine visualized this situation, showing that as a result of the growing complexity of modern economic life and the abnormal conditions since the war, there have arisen a multitude of economic and social problems with which the stations have not been adequately prepared to cope, but for whose services there has been insistent demand. "The Purnell Act is the Government's answer to this appeal for help. Building on the splendid foundation that already has been laid, the act greatly broadens the research work of the stations. While some of the work performed with these funds may lie in fields already occupied, it is believed that the framers of the law intended that for the present at least large emphasis should be placed on the economic and social problems of agriculture."

This view was corroborated by President Pearson as having been brought out in the later hearings before Congress on the bill. He also referred to the acceptance of the measure in many quarters as in this sense emergency legislation of the most constructive type. Director Thatcher, speaking for the President's Agricultural Conference, emphasized the great need felt by that body for unbiased fact-finding agencies, basing their conclusions on comprehensive investigation as a constructive factor in the relief of agriculture. Likewise, President Butterfield conceived the act to provide for three main lines of inquiry—the food supply for man and animals, the provision of an efficient and permanent agriculture, and the study of the rural home and rural life with a view to maintenance of living standards that will keep farm people out of a potential peasant class.

As regards home economics, Secretary Jardine drew attention to the fact that the legislation for the first time gives ample authority for carrying on investigational work in this field. The problems of the home include some of the most vital factors in the development of a permanent and satisfactory rural life, and, as he stated, "if farm management studies have contributed to economy and efficiency in the operation of the farm, similar studies in home management should give equal returns in lightening the burdens of the farm woman and give added opportunity for the care and training of children, for social and community work, and for the organization

of a more satisfactory home life. . . . Money invested in these problems may not yield as immediate returns in the farm income as studies on the feeding of pigs, but it may easily mean immensely more in the development of a sound and enduring agricultural civilization on which to found a prosperous and progressive nation. Taken as a whole, the home economics field should receive every possible encouragement, and wherever leadership is available serious investigational work should be undertaken."

Notwithstanding the interest manifested in these newer subjects of inquiry, it was pointed out by a number of speakers that the stations are by no means confined to them. Secretary Jardine predicted that the meeting would undoubtedly "spend the major portion of its time in the discussion of economic problems, on the one hand, and those of the home and rural life, on the other—problems that have not received adequate consideration in the past. Still," he declared, "it must not be forgotten that production problems are, after all, fundamental, and that every possible reduction in the cost of production, every handicap to production removed or controlled, every improvement in the production of a variety or a breed, is a permanent contribution not only to agriculture but to national progress and development as well."

This view was further supplemented by the Chief of the Office of Experiment Stations, who pointed out that "any investigations or experiments appropriate to the Hatch Act will be appropriate under the new act, and it is likely that it will be desired to use the latter to some extent in strengthening lines of work in which the stations are now engaged. Comparatively small additions to the funds now available for some well-established projects may hasten conclusions or possibly mark the difference between comparative failure and definite success. Wise administration of the Purnell Act will therefore call for consideration of the claims of existing projects, along with those of new undertakings."

The theme of cooperation and coordination in the developments under the new act was stressed at the meeting as never before in the history of the stations. Dean Dodson of Louisiana pointed out, for example, that the phrase "the establishment and maintenance of a permanent and efficient agricultural industry," which is one of the leading objects of the act, applies not to the States separately but to the Nation as a whole. Independently planned and overlapping investigations, in his view, would not be in the interest of economy or efficiency, and a broad, patriotic viewpoint must be maintained. Full realization was expressed of the fact that many types of investigation must be left to individuals, and that in the past some of the

largest contributions have come in this way, but at the same time it was felt that the conduct of the stations' inquiries to so large an extent on an independent basis has prevented the most effective attack, and has deprived individual workers of knowledge of what others were doing which would have been helpful in hastening a solution of their problems. None the less, there have been notable examples of successful cooperation which have helped to demonstrate the feasibility of joint effort, and these give confidence in the practicability of a considerable extension in that direction.

The interest of the Federal Government in cooperation was set forth by Secretary Jardine, and its desire to join hands with the stations in the study of national or regional problems was made very clear. It was frankly admitted that a lack of such coordination in the past has resulted in considerable duplication and has stood in the way of the highest efficiency in the investigation of many broad questions. As he expressed it, "cooperation is good for research people as well as for farmers. Waste and needless duplication are just as reprehensible in research as in the handling of farm products, and the Department of Agriculture and the experiment stations should set farmers an example in the elimination of wasteful methods."

"It is a reasonable expectation," he went on to say, "that the Purnell Act will lead to a considerable enlargement of the cooperative relations between stations and with the various bureaus of the department. This seems important at the present juncture. It is in line with the idea of organizing investigation around problems instead of around a single station department. Very many of the problems we now face are too large for individual States acting separately. They are regional or even national, and there is danger of viewing them too narrowly. An experiment station working single-handed can rarely expect to reach conclusive and comprehensive results in such broad subjects. It is important for both the institution and the investigator in many cases to detach themselves sufficiently from the local aspects of a question to view it impartially in its relation to the underlying problem and to what others are doing about it."

Especially encouraging and effective was the spirit of cooperation in which the conference abounded and its numerous practical manifestations. There was a widespread determination to make the new funds count for the utmost possible in research and, to that end, to take counsel on problems of both national and regional character as to how they could best be approached and studied. An important outcome was the selection from a large number of projects submitted of six comprehensive problems of national scope in which the stations and the Department of Agriculture might cooperate. These included

the distribution and marketing of farm products, the problem of surpluses of farm products, the vitamin content of foods in relation to human nutrition, rural home management studies, rural social organizations and agencies essential to a permanent and efficient agriculture, and factors influencing the production and quality of meats. It will be noted that the first two of these problems lie specifically in the field of agricultural economics, the third and fourth in home economics, the fifth in rural sociology, and the sixth in a branch of production.

Each of these topics is recognized as a very broad one, including many aspects and phases which will give opportunity for approach from various points of view and with specialized methods of study. These larger problems can not be studied as units, and rarely can all phases of them be carried on at the same time. But an advantage will be in having the work so coordinated that it may be more definitely directed toward determined ends, and within this range the field may be more adequately covered.

Special committees of experts were provided to handle these several problems. These committees have since been selected by the executive committee of the Association of Land-Grant Colleges, acting under authority granted by the conference and on the basis of nominations received from the various stations. They will concern themselves with the respective problems to which they relate and not with the broader fields, and it will be their duty to convene at an early date for the purposes of study, determining what is necessarily involved and what it is most important to take up at the outset, and thus blocking out the field and the course of procedure. Some of the stations have already indicated the problems in which they wish to cooperate, and the particular aspects of the investigation they would be in best position to carry on. The way will be open for others to express their readiness, and in certain prominent cases institutions or investigators will doubtless be invited to take part or to exercise leadership in particular features. This preliminary work of the committees will help to bring the investigation of individual stations down to a specific and limited scope suited to the setting up of projects. Another part of the plan will contemplate the review of the programs on these problems by the joint committee of the association on projects and correlation of research, consisting of representatives from the stations and the department.

It is hoped to get these cooperative undertakings into operation at an early date, even though they may possibly need modification as time goes on. The fact was stressed at St. Louis of the expectation which these increased funds would arouse, and the necessity of getting work organized and in full swing as promptly as circumstances permit. Obviously investigation can not be hurried, but the prepara-

tions for it can be given the right of way and the actual inauguration of operations thus be speeded up.

One advantage of coordination and unified action should be an increased concentration of the attack on a limited number of specific features, in place of the broad diffusion over the whole field likely to occur under independent and unrelated action. Another advantage from analysis of the field and the work by a committee of specialists is likely to be a weighing of the relative importance at the present time of various aspects of large problems, the determination of things which should take precedence, and the discovery of gaps in the range of investigation which need to be provided for.

Another feature of the conference was the holding of sectional meetings made up of representatives from typical regions. Such conferences were held by the northeastern group of stations, the Corn Belt group, the cotton States, and the intermountain and western group. These sections discussed problems of common interest which it was thought would lend themselves to helpful cooperation, frequently adopting two or three such problems as a beginning. Officers were selected to carry forward the plans thus provided for.

The conference was also helpful in drawing attention to various administrative problems confronting the stations as the act goes into operation. The shortage of trained personnel in the newer lines of research was referred to as restricting developments in some cases, but also as a condition which should be overcome at the earliest opportunity. The funds available under the act are also limited for the ensuing year, and obviously should not be spread over too many directions. Research programs should, however, take cognizance of the contemplated increases under the provisions of the act and prepare for development.

With the enlargement of the stations' activities and the broadening relationships, the direction of an experiment station will become increasingly important. As Secretary Jardine stated, "it will require not only special qualifications, but will call for time to study the lines in which research is most needed, for the effective organizing of these efforts, and for securing and sustaining men and women of the right type for productive research. This important function of administration ought not to be made incidental to other lines of activity, and especially in the large institutions it will be necessary to provide specifically for it. Manifestly the proper organization and manning of this research branch, the maintenance of contacts within and without the individual institutions, and the efficient direction of a program of research employing from \$100,000 to a quarter of a million annually, calls for high qualifications and a large measure of freedom from other engrossing duties."

Timely counsel along the same line was also given by the Chief of the Office of Experiment Stations. As he expressed it, "the administration of the stations will form a highly important feature in determining the success of the new act. The idea that research does not call for capable administrative attention is not borne out by the experience of the past twenty-five years. This is particularly the case when special ends are in view, and when the staffs are made up of people of varying ability in the field of research and having other duties."

In his opinion, the whole administrative situation has now changed. It will no longer suffice for directorship to be casual; "it will need to be aggressive, sympathetic, and discriminating. With the contemplated expansion of the field may well go a thorough survey of the work in hand, with a view to the possible redirection of some of the types of work long in progress. The size of the personnel will grow, and the new members will need to be selected and started on their work with care. These things will call more than ever for an officer of experience in research, with time to study the work and the field of the station, to counsel with and promote the efforts of his staff, and to maintain the necessary contacts within the college and outside of it."

Doctor Allen went on to stress the need of promoting by all feasible means, along with the strengthening of administration, the conditions of work which make for steady and substantial progress in investigation. Not only adequate facilities but freedom of time, relief from excessive pressure from teaching or extension work, and the provision of effective assistance and the necessary collaboration of other groups of workers are among the special needs if full efficiency is to be forthcoming.

Next to the inauguration of the American system of experiment stations, the passage of the Purnell Act is the most momentous step in the progress of agricultural investigation in any country. The wisdom of counsel at this time is beyond question. The history back of experiment station work will lead to large expectations. Fortunately, scientific results are not the only product which has come out of the past. The experience gained in organization, administration, the building up and direction of personnel, and the maintenance of close contacts with science on the one hand and with practice and the business of agriculture on the other, will be a source of strength in this period of expansion. The readiness to counsel, to receive suggestion, to accept leadership, as exemplified in the St. Louis conference and subsequent developments, is evidence of a spirit which has developed to a point hardly to be found in a similar group in any other country or any other branch of science.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Chemical encyclopaedia, C. T. KINGZETT (*New York: D. Van Nostrand Co., 1924, 3 ed., pp. X+606*).—This is a revised and enlarged edition of the volume previously known as *The Popular Chemical Dictionary* (E. S. R., 47, p. 801).

Chemical dictionary, H. REMY (*Chemisches Wörterbuch. Leipzig: B. G. Teubner, 1924, pp. VIII+416, figs. 15*).—This dictionary of chemical terms is one of a series of technical dictionaries entitled *Teubners Kleine Fachwörterbücher*.

Colloid chemistry, J. ALEXANDER (*New York: D. Van Nostrand Co., 1924, 2. ed., rev. and enl., pp. VIII+208, pls. 3, figs. 6*).—This is a revised and enlarged edition of the volume previously noted (E. S. R., 41, p. 310).

Fifth report on colloid chemistry and its general and industrial applications, F. G. DONNAN ET AL. (*Brit. Assoc. Adv. Sci., Rpt. Colloid Chem. [etc.], 5 (1923), pp. [3]+130*).—This final report of the series previously noted (E. S. R., 49, p. 308) contains the following papers: *The Measurement of Surface Tensions*, by A. Ferguson; *Report on Collagen and Gelatin*, by H. R. Procter and J. A. Wilson; *Colloid Phenomena in Bacteriology*, by E. K. Rideal; *Industrial Applications of Wetting Power*, by W. H. Nuttall; *Colloids in Relation to the Manufacture of Inks*, by C. A. Mitchell; and *The Manufacture of Artificial Silk in Relation to Colloid Chemistry*, by E. Wheeler. Subject and author indexes to the five reports are appended.

Starches, W. A. NIVLING (*New York: Barr-Erhardt Press, Inc., 1924, pp. VII+82, figs. 25*).—This is a brief discussion of the physical properties of solutions of the natural or unmodified starches as related to testing for fluidity and to their use in sizing textile fibers. Illustrations of apparatus and photographs showing the penetration of sizing in yarn are included.

The polysaccharides, H. PRINGSHEIM (*Die Polysaccharide. Berlin: Julius Springer, 1923, 2. ed., rev., pp. V+234*).—In this revision of the volume previously noted (E. S. R., 45, p. 310) a discussion of the literature on the subject through 1922 is included, with footnote references.

Modern cereal chemistry, D. W. KENT-JONES (*Liverpool: Northern Pub. Co., Ltd., 1924, p. IX+324, figs. 23*).—The first two chapters of this textbook for cereal chemists and millers deal with the general composition of wheat flour and the differences in wheat varieties and with the vitamin content of wheat and flour. These are followed by chapters on colloidal chemistry and H-ion concentration which serve as an introduction to a discussion, based upon recent literature, of the colloidal chemistry of flours and the baking process. The remaining chapters deal with the composition of mill products, bleaching and flour improvers, conditioning, moisture in wheat and flour, and analysis of flour. A foreword by W. Jago and an appendix containing the approved and tentative methods of analysis of the American Association of Cereal Chemists are included.

Some nitrogenous constituents of the juice of the alfalfa plant.—I, The amide and amino acid nitrogen, H. B. VICKERY (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 647-655).—This paper reports a continuation of the investigation of the constituents of the alfalfa plant, previous reports of which by Osborne et al. have been noted (*E. S. R.*, 48, p. 201). The present study was limited to the distribution of amide and amino acid nitrogen in the filtrate obtained when the juice expressed from the fresh ground alfalfa plant was treated with 53 per cent of its weight of alcohol to precipitate proteins and other organic matter.

A system of fractionation was employed by means of which various groups of nitrogenous constituents were separated. The first precipitant used was normal lead acetate, which precipitated 10.7 per cent of the total nitrogen, 15.2 per cent of the amino nitrogen, and 14.2 per cent of the organic solids of the alfalfa filtrate. The filtrate from the first precipitation was treated with mercuric acetate, sodium carbonate, and alcohol, which precipitated amino acids and certain basic substances. The basic substances were removed by decomposing the precipitate with hydrogen sulfide and reprecipitating with phosphotungstic acid, and the amino acids and amides were removed from the filtrate of the phosphotungstic acid precipitate by fractional recrystallization. The phosphotungstic acid precipitate was decomposed into purine, arginine, and lysine fractions by precipitation with silver sulfate and the silver sulfate with barium hydroxide. The filtrate from the second precipitate with mercuric acetate, etc., was precipitated with mercuric chloride.

There were finally identified in the various fractions asparagine to the extent of 1.82 per cent of the organic solids or 5.82 per cent of the total nitrogen of the filtrate, simple α -amino acids to the extent of 13.6 per cent of the total nitrogen, less than 0.2 per cent of tyrosine, and a small amount of polypeptides.

Some nitrogenous constituents of the juice of the alfalfa plant.—II, The basic nitrogen, H. B. VICKERY (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 117-127).—The precipitate and filtrate from the Newberg reagent in the scheme of fractionation of alfalfa juice noted above have been examined for basic substances with the following results, calculated in grams per liter of concentrated alfalfa filtrate representing the juice of approximately 6,460 gm. of the fresh plant: Arginine 0.522 gm., lysine 0.073, stachydrine 3.768, choline 0.249, chloride of a purine 0.048, and a base yielding a picrate of melting point 298° C. 0.290 gm.

It is pointed out that since the above substances have been isolated from the unhydrolyzed filtrate they must occur free or as salts in the juice of the alfalfa plant.

A contribution to the chemistry of grape pigments.—II, Concerning the anthocyanins in Clinton grapes, R. J. ANDERSON and F. P. NABENHAUER (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 97-107).—The studies previously noted (*E. S. R.*, 50, p. 410) have been extended to the Clinton grape, a cultivated variety of *Vitis riparia* crossed with *V. labrusca*.

The pigment occurring in Clinton grapes was found to be identical with the anthocyanins isolated from the Norton and Concord grapes. The anthocyanadin chloride prepared as in the previous study was found to consist largely of a monomethyl ether of delphinidin but to contain some of the corresponding dimethyl ether.

The lipochromes of etiolated wheat seedlings, K. H. COWARD (*Biochem. Jour.*, 18 (1924), No. 5, pp. 1123-1126).—Wheat seeds in which no traces of lipochromes could be found were germinated and grown in the dark for 17

days, and the etiolated shoots tested for lipochromes. Carotin and four xanthophylls known to be present in green leaves were identified in the shoots.

Recent work on insulin. C. H. BEST (*Endocrinology*, 8 (1924), No. 5, pp. 617-629, figs. 2).—The author reviews briefly recent work on the preparation of insulin, methods of testing, yield and distribution, and the insulin-like material in plants. Preliminary experiments are also reported on the effects of varying doses of insulin on dogs. These show an irregularity in results, a large dose not invariably producing a greater effect than a small dose. It is considered probable that insulin may be stored to some extent in the body.

A list of 35 references to the literature is appended.

The influence of insulin on the glucose-fermenting action of *Bacillus coli*. G. MCGUIRE and K. G. FALK (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 489, 490).—The presence of insulin was found to have no influence upon the fermentation of glucose by *B. coli*.

The fermentation of pentoses by *Bacillus granulobacter pectinovorum*. W. H. PETERSON, E. B. FRED, and E. G. SCHMIDT (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 627-631).—Data are reported on the total fermentation products obtained from xylose, arabinose, and glucose by the action of *B. granulobacter pectinovorum*.

The rate of fermentation was somewhat slower for the pentoses than for glucose, but practically all the sugar was destroyed in 72 hours and the same products were formed. The amount of volatile acids was slightly greater and of solvents slightly smaller in the fermentation products of the pentoses than of glucose.

The formation of l-leucic acid in the acetone-butyl alcohol fermentation. E. G. SCHMIDT, W. H. PETERSON, and E. B. FRED (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 163-175).—"A nonvolatile acid produced by *Bacillus granulobacter pectinovorum* from corn mash has been isolated, and shown to be l-leucic acid (α -hydroxyisocaproic acid). The acid is orthorhombic in crystallization, and the acute angle measures $72^\circ (\pm 3^\circ)$. It has a melting point of $75-77^\circ$ C. and a specific rotation of -9.23 .

"The acid yields a calcium salt corresponding to the formula $(C_6H_{11}O_3)_2Ca$. The zinc, carbon, hydrogen, and oxygen content of the zinc salt corresponds to that required for the salt, $(C_6H_{11}O_3)_2Zn$. The zinc salt crystallizes with 7 to 7.5 per cent of water ($1\frac{1}{2} H_2O$)."

The production of organic compounds of sulphur in bacterial cultures, with special reference to glutathione. J. W. MCLEOD and J. GORDON (*Biochem. Jour.*, 18 (1924), No. 5, pp. 937-940).—On applying the nitroprusside test for glutathione to 24- to 48-hour cultures of various bacteria, positive reactions were obtained with all of the anaerobes and facultative anaerobes but not with the aerobes tested. That this reaction was due not to the production of glutathione by the bacteria but to the reduction of the residual oxidized glutathione present in the medium is thought to be proved by the negative results obtained when the medium has been freed from substances reacting with nitroprusside, and by positive results in media not containing bacteria but subjected to prolonged reduction by aluminum mercury couples.

It is concluded that bacteria do not produce glutathione, but that certain bacteria which are capable of reducing glutathione utilize it when growing under anaerobic conditions to obtain oxygen necessary for their metabolism.

Comparative study of *Lactobacillus acidophilus* and *Lactobacillus bulgaricus*. W. L. KULP and L. F. RETTGER (*Jour. Bact.*, 9 (1924), No. 4, pp. 357-394, pl. 1).—In this comparative study of *L. acidophilus* and *L. bulgaricus* a

tryptic digest of casein or milk powder (Klim) was used as the nitrogenous base for the media employed.

In morphological and cultural characteristics the two species proved very similar, the chief differences being in their fermentative action on maltose, sucrose, and levulose. All strains of *L. acidophilus* and only two of *L. bulgaricus* fermented lactose, all strains of *L. acidophilus* and only one of *L. bulgaricus* reacted with sucrose to form acid, and all strains of *L. acidophilus* but two fermented both heated and unheated levulose, while *L. bulgaricus* fermented only the heated levulose. The other chief point of difference is in the habitat. *L. acidophilus* lives and develops in the intestines of man and animals, while *L. bulgaricus* is unable to do so.

"The differences noted between these two types constitute evidence enough for classifying them as separate species. However, because of the various close relationships, it is suggested that these two types be placed in one and the same species of which *L. acidophilus* is the central type and *L. bulgaricus* a variant."

A note on the gravimetric microchemical technique, L. DIENES (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 73-76, fig. 1).—The author recommends in microgravimetric determinations the separation of the precipitate by centrifugation instead of by filtration. A special precipitation tube with conical bottom is described and illustrated, with methods for its use. The materials are introduced into the tube by means of a mounted pipette graduated in 0.01 cc., and the washing liquid is introduced by means of a capillary tube in such a way as to stir up the precipitate.

The buffer mechanism for the calcion concentration and the determination of calcion buffer values, I. N. KUGELMASS (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 237-256, figs. 2.)—This is a theoretical discussion of the regulation of calcium ion concentration by carbonate and phosphate buffers, with derivations of equations for determining the buffer values of different solutions in terms of calcium concentration.

The determination of nitrogen in connection with the wet combustion method for carbon, A. K. ANDERSON and H. S. SCHUTTE (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 57-61).—The wet combustion method of Rogers and Rogers, as modified by Gortner (*E. S. R.*, 36, p. 512), has been found to be suitable for the determination of both carbon and nitrogen, the latter by making alkaline the residue from the digestion with chromic acid and distilling the ammonia as in the usual Kjeldahl process. If chlorides are present, it is necessary to aerate the sample for about 30 minutes in the presence of hot sulfuric acid before adding the potassium dichromate.

The determination of ammonia in soil, N. BENGTSSON (*Soil Sci.*, 18 (1924), No. 4, pp. 255-278).—Various direct methods of determining ammonia in soils have been tested on eight different soils, the criterion of accuracy being the quantitative recovery of added ammonia, as well as the ammonia originally present in the soil.

With none of the methods tried, which included those of Boussingault, Baragiola and Schuppli, Potter and Snyder (*E. S. R.*, 33, p. 411), Matthews (*E. S. R.*, 43, p. 211), and Gibbs, Neidig, and Batchelor (*E. S. R.*, 50, p. 203), was there a quantitative recovery of added ammonia.

Experiments with different extracting agents showed that in general it is impossible to bring all of the ammonia into solution by one extraction. Of the various reagents tested, potassium chloride proved most effective. In the case of surface soils, the successive extraction with fresh solutions of 4 per cent potassium chloride resulted in the quantitative removal of the ammonia,

but with heavy clay subsoils taken from a depth of from 25 to 35 cm., the successive extraction process was unsatisfactory.

On the basis of these results, the method recommended for the determination of ammonia in surface soils consists in the successive extraction at room temperature of 25 gm. of soil with 4 per cent potassium chloride solution, using at the most 7 100-cc. portions for mineral soils and 10 50-cc. portions for peat soils. The combined filtrates are distilled with magnesium oxide, and the liberated ammonia is caught in $N/10$ H_2SO_4 . After the distillation is finished the distillate is boiled to remove CO_2 , cooled, and titrated with $N/10$ $NaOH$, with methyl red as indicator. Blank determinations should be made with the reagents alone.

Methods of studying the strength of soil acids, J. W. TIDMORE and F. W. PARKER (*Soil Sci.*, 18 (1924), No. 4, pp. 331-338, fig. 1).—This study was confined to a comparison of three methods of measuring the intensity factor in soil acidity—H-ion concentration by the electrometric method, sugar inversion, and the Truog avidity method (E. S. R., 35, p. 503). Twenty-five soils, representing 15 soil types, were used in the comparison, and in all cases the amounts of the soils were varied according to their lime requirement so that all would contain the same amount of acid.

The results of the three methods showed good correlation, as indicated by the calculated coefficients of correlation, which are as follows: Truog avidity and sugar inversion methods, 0.899 ± 0.025 ; Truog avidity method and H-ion concentration, 0.789 ± 0.050 ; and sugar inversion method and H-ion concentration, 0.817 ± 0.045 . This is considered to indicate, as pointed out in a previous paper by Parker and Bryan (E. S. R., 49, p. 722), that the H-ion concentration of the soil solution is largely determined by the acidity of the acid silicates of the soil.

A study was also made of the effect of the presence of different amounts of soils in the solid phase on the rate of inversion of sugar when the H-ion concentration and conductivity of the solutions were the same. With increasing amounts of the solid phase the rate of hydrolysis was increased. This is explained as follows:

"There is a higher concentration of H-ions at the surface and in the interior of the gel-like aggregates of soil colloids than in the free soil solution. This difference in the H-ion concentration is readily explained by Donnan's theory of membrane equilibria. The colloids of a mineral acid soil are complex hydrogen aluminum silicates. On hydrolysis these silicates give diffusible H-ions and nondiffusible silicate ions. According to Donnan's theory the presence of the nondiffusible ion causes an unequal distribution of the diffusible ions. In an acid soil suspension there would be a higher concentration of H-ions at the surface of the soil particles than in the free soil solution."

A modification of the molybdic method for the determination of inorganic phosphorus in serum, S. R. BENEDICT and R. C. THEIS (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 63-66).—Slight changes in the Briggs modification (E. S. R., 48, p. 111) of the Bell-Doisy method of determining inorganic phosphorus are described, by means of which the color produced is said to be about three times as intense as that obtained by the Briggs procedure.

Method of estimating minute quantities of iodine in biological material, F. C. KELLY and A. D. HUSBAND (*Biochem. Jour.*, 18 (1924), No. 5, pp. 951-956).—The authors discuss briefly the advantages and disadvantages of several methods of determining iodine when occurring in small amounts in biological material, and describe in considerable detail the Kendall method (E. S. R., 44, p. 113) which, with slight modifications, they have adopted as the most satis-

factory. This method is considered to have an absolute limit of accuracy of 0.0001 gm. per hundred. The minimum amount of N/200 sodium thiosulfate with which a change of color could be observed was 0.05 cc., equivalent to 0.0000317 gm. of iodine.

Observations on a micro method for the determination of silicon and on the content of this element in certain organs [trans. title], G. BERTRAND (*Bul. Soc. Chem. Biol.*, 6 (1924), No. 7, pp. 656-658).—Attention is called to one or two sources of error in the micro method of determining silicon described by Isaacs (*E. S. R.*, 51, p. 612). It has been found that the color does not reach its maximum intensity for some time, the interval depending on the thickness of the tubes, the external temperature, etc. It has also been found that at the same concentration a blue color is developed in the presence of phosphoric acid after a much longer period. In the presence of large amounts of P_2O_5 it is considered probable that the color would develop as quickly as with small amounts of silicon. This is thought to account for the high figures reported by Isaacs for the content of silicon in the brain.

Further studies on the determination of calcium, magnesium, and phosphorus in animal substances, L. DIENES (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 77-90).—Slight modifications in the author's microgravimetric method of determining calcium, magnesium, and phosphorus in animal substances (*E. S. R.*, 43, p. 204) are described.

The identification of glycerol by a bacterial method, A. CASTELLANI and F. E. TAYLOR (*Jour. Trop. Med. and Hyg. [London]*, 27 (1924), No. 20, pp. 271-273, figs. 3).—The mycological-bacterial method for the identification of carbohydrates previously described (*E. S. R.*, 49, p. 112) has been extended to the identification of glycerol. Mycological formulas for its identification are appended.

The chemical examination of various peat materials by means of food stuff analyses, A. P. DACHNOWSKI (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 2, pp. 69-83).—In studies conducted by the Bureau of Plant Industry, U. S. D. A., the results obtained with 20 different kinds of peat indicated the feasibility of the application of foodstuff analyses for the determination of qualitative differences in sedimentary, fibrous, and woody peat materials. These data pointed to contrasts between peat materials in regard to their nitrogenous substances, lignin, cellulose, and other carbohydrates, waxes, resins, and similar plant products. Their value was found to be necessarily limited, since it was only possible to utilize analyses of the same character as those used for crops and feeding stuffs. However, they illustrated the fact that a close connection exists between the botanical and chemical composition of the main groups of peat.

By the application of this method it becomes possible to correlate variations in the chief groups of organic compounds with structural differences in the profile of peat deposits, to follow the progress of decomposition in drained surface peat soils, and to determine the degree of chemical alteration taking place in the several layers of peat below the water level.

The analyses showed the wide differences in agricultural value of the several kinds of peat, on the basis of the ratio of nonnitrogenous to nitrogenous materials, and the limited usefulness of various kinds of raw peat as a source of food for livestock or for soil microorganisms.

A system of blood analysis.—Supplement V, The improvements in the quality and method of preparing the uric acid reagent, O. FOLIN and H. TRIMBLE (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 473-479, fig. 1).—In this supplement to the system of blood analysis of Folin and Wu (*E. S. R.*, 47, p. 410), a simple method is described for preparing the uric acid reagent almost

entirely free from molybdenum. The process depends upon the fact that the molybdenum is precipitated as sulfide by hydrogen sulfide in the presence of phosphoric acid. Certain improvements are also reported in the ordinary process for making the uric acid reagent from normal sodium tungstate, sodium paratungstate, and ordinary phosphotungstic acid.

Estimation of sugar in the blood, E. G. B. CALVERT (*Biochem. Jour.*, 18 (1924), No. 5, pp. 839-844, fig. 1).—This paper consists of a refutation of the criticism of Stanford and Wheatley (*E. S. R.*, 51, p. 507) in regard to the author's previously described method of estimating the sugar content of the blood (*E. S. R.*, 49, p. 408), and a detailed description of this method, modified by the substitution for the platinum capsule of a special pipette for collecting measured amounts of blood.

An apparatus for the exact analysis of air in metabolism investigations with respiratory exchange chambers, T. M. CARPENTER (*Jour. Metabolic Research*, 4 (1923), No. 1-2, pp. 1-25, fig. 1).—A gas analysis apparatus, based upon the Haldane principle, has been devised for use with the large respiration chamber for animals described by Benedict et al. (*E. S. R.*, 44, p. 68). The apparatus is described and illustrated, with directions for its manipulation and data showing its accuracy. "It has a capacity of 40.04 cc., and readings can be made to 0.001 per cent. Samples of gases containing as much as 1.7 per cent of carbon dioxide and from 78.4 to 79.6 per cent of nitrogen can be analyzed with this apparatus. Analyses of outdoor air have given 0.030 ± 0.003 per cent for carbon dioxide and 20.940 ± 0.003 per cent for oxygen."

Sugar machinery, A. J. WALLIS-TAYLER (*London: William Rider and Son, Ltd.*, 1924, pp. XVI+410, pl. 1, figs. 162).—This is a descriptive treatise devoted to the machinery and processes used in the manufacture of cane and beet sugar. It contains chapters on the sugar cane; complete cane sugar factories; the extraction of the juice from the raw material; modern types of cane mills; safety devices for cane mills, etc.; motive power for cane mills, etc.; the treatment of the juice prior to concentration; concentration under atmospheric pressure; concentration in vacuo; extracting the molasses from the sugar; tests; beet sugar; the manufacture of beet sugar; treatment of the juice; evaporation and concentration; sugar refining; and the distillation of rum. Appendixes are included on sugar packeting machinery, useful tables, bibliography, etc.

The manufacture of vanillin, P. MAY (*Perfumery and Essential Oil Rec.*, 15 (1924), No. 11, pp. 351-358).—A review of the literature on the manufacture of vanillin from the first artificial production 50 years ago to the present time.

METEOROLOGY

Solar and terrestrial radiation, A. ÅNGSTRÖM (*Quart. Jour. Roy. Met. Soc.* [London], 50 (1924), No. 210, pp. 121-126, pls. 2).—This article is of interest especially from the standpoint of the methods and apparatus employed to measure the total radiation income and to evaluate the factors affecting it, to determine the relation to sunshine and cloudiness, and to interpret the data obtained.

"A treatment of the registration at Stockholm gives the result that the total radiation-income Q_s during the day may be expressed by the formula:

$$Q_s = Q_0(0.25 + 0.75 \cdot S), \quad "$$

where Q_0 is the radiation-income which corresponds to a perfectly clear day, and S is the time of sunshine expressed in the greatest possible time of sunshine as unit. . . .

"As the radiation-income from perfectly overcast skies is a function of the mass of precipitated water in the atmosphere, the registrations give a means to evaluate the 'capacity' of the cloud layer. . . . The radiation during clear and half-clear days has a minimum in the afternoon hours (between noon and 4 p. m.). . . . Radiation during days with overcast or nearly overcast skies has a maximum in the afternoon hours (between noon and 4 p. m.). These results are explained by the influence of convection, which gives rise to a creation of cumulus clouds during clear or almost clear days but causes breaches in the uniform cloud layer of the overcast skies. A close relation is found to exist between the evaporation and the radiation-income during the day. As the evaporation depends in high degree upon the vertical convection, and the convection in its turn upon the heating of the ground through radiation, this result is a natural one.

"From the previous summary the great importance of continuous registrations of the radiation must be clear. The proposal seems therefore justified that a recording actinometric station ought to be erected in every country."

General and physiological features of the vegetation of the more arid portions of southern Africa, with notes on the climatic environment, W. A. CANNON (*Carnegie Inst. Wash. Pub. 354* (1924), pp. VIII+159, pls. 31, figs. 13).—This publication gives a somewhat detailed account of the climate of the southern part of Africa, especially with reference to the amount and distribution of rainfall in its relation to distribution and growth of plants, the plant studies dealing particularly with "(1) the perennial flora of the more arid regions, (2) the climatic environment, (3) plant habits and plant habits, (4) comparative structure of leaves, and (5) the transpiring power of leaves."

Comparing climatic conditions and vegetation of this region with that of other similar regions, it is observed that like conditions of rainfall are not necessarily associated with plant growth of the same character and distribution. "The leading features of the climatic environment of plants of arid regions can be said to lie in the temperature and its variation, in the intensity of light, and in the amount and seasonal distribution of the rainfall, together with certain other related factors, including the frequently low relative humidity. A change in one of these, particularly in the amount or the season of the rains, very profoundly modifies the rest, with consequent serious alteration in the environic complex as a whole.

"Thus, when the rainfall is in the cool season only, when the temperature is low, the humidity high, and the light values low, the aridity of the drought period is accentuated by the fact of high temperatures, low relative humidity, and high light values. When, on the other hand, the rainy period coincides with the warm season, the period of drought is not so markedly arid, for the reason that the temperature at the time is relatively low, with correspondingly high relative humidity and relatively low light intensity. Accordingly, it is not difficult to understand why, in regions of winter rainfall, the perennials should have pronounced xerophytic characteristics, even if the amount of rain be considerable.

"In regions with equal precipitation, but occurring the one in the cool and the other in the warm season, it appears to be the rule that the former is the more arid. In certain arid and semiarid regions of the world both types of rainfall occur. In such event, if the rains of summer and of winter are fairly large, as in southern Arizona, the vegetation is correspondingly abundant, but in case the periodic rains are uncertain, both as to amount and season, the arid conditions may be intense. The latter obtains in central Australia and in a portion of South Africa, especially in the Karroos."

The climatic conditions of southern Africa are discussed with reference to latitude, topography, proximity to the ocean, and relation to regions of permanent low atmospheric pressure. "There is a gradual increase [in temperature] on any parallel of latitude from the west to the east and along the west coast from the north to the south and along the east coast from the south to the north." In general the climate is mild temperate. In the interior the summers are hot and the winters cool, with heavy frosts and snows in the mountains. A marked feature of the rainfall is its periodicity. On the east the rains occur mainly in summer, on the west mainly in winter. In general the total rainfall increases from the west to the east and to a less marked and constant extent from the south to the north.

The effective rainfall, 0.15 in. or more, is relatively high. "In the Karroos, for example, it ranges between 86 and 92 per cent. Even at Laingsburg, where the annual precipitation is extremely low, it is about 89 per cent effective. About 52 per cent of the rainfall at this place is in summer." Where the rainfall is relatively large the noneffective rainfall is relatively small.

There is evidently a "close relation between the character of the vegetation, including often the local distribution, and the general facts as to the amount and seasonal distribution of the rainfall. And an important feature of the environmental complex is the fact of often long yearly periods of drought, which may be associated with seasons of high temperature, in which event the aridity is particularly intense."

Climatological data for the United States by sections, [November-December, 1924] (*U. S. Dept. Agr., Weather Bur. Climat. Data, 11 (1924), Nos. 11, pp. [187], pls. 4, fig. 1; 12, pp. [194], pls. 5, fig. 1.*)—These numbers contain brief summaries and detailed tabular statements of climatological data for each State for November and December, 1924.

Meteorological observations at the Massachusetts Agricultural Experiment Station, J. E. OSTRANDER and J. BOWER, JR. (*Massachusetts Sta. Met. Buls. 433-434 (1925), pp. 4 each.*)—Summaries are given of observations at Amherst, Mass., on pressure, temperature, humidity, precipitation, wind, sunshine, cloudiness, and casual phenomena during January and February, 1925. The data are briefly discussed in general notes on the weather of each month.

SOILS—FERTILIZERS

Soil survey of the San Simon area, Arizona, E. J. CARPENTER and W. S. BRANSFORD (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+583-622, pls. 3, fig. 1, map 1.*)—This survey, made in cooperation with the University of Arizona, deals with the soils of an area of 286,720 acres lying in the northeastern part of Cochise County in the extreme southeastern part of Arizona. The greater part of the area is smooth enough for irrigation with but little leveling, and drainage is well established except in local areas.

The soils differ widely in origin, color, physical properties, lime content, drainage, and crop adaptation. They are grouped as old valley filling soils, recent alluvial, and miscellaneous materials. Including rough stony land and riverwash, 20 soil types of 10 series are mapped, of which the Cavot and Mohave gravelly sandy loams cover 39.5 and 16.1 per cent of the area, respectively. Analyses of soils for alkali showed that the areas within injurious alkali accumulations are small, being confined largely to the recent alluvial soils along San Simon Creek and to some of the more poorly drained old valley filling soils.

Soil survey of the Victorville area, California, A. E. KOCHER and S. W. COSBY (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+623-*

672, pls. 4, figs. 2, map 1).—This survey, made in cooperation with the California Experiment Station, deals with the soils of an area of 226,560 acres lying along the southern margin of the Mohave Desert in the southwestern part of San Bernardino County in southern California. With the exception of the mountain foot slopes along the south side and a few scattering buttes and low rocky ridges, the area in general is smooth. The area is a structural basin which has been filled in to a depth of several hundred feet.

The soils, which are formed mainly of granitic material, range in color from grayish brown to red. Including rough broken land, rough stony land, riverwash, and dunesand, 20 soil types of 7 series are mapped, of which the Hesperia loamy sand, Adelanto sandy loam, Hesperia sand, and Adelanto sand cover 16.6, 15.9, 12.1, and 11.8 per cent of the area, respectively. It is stated that a large portion of the area is adapted to irrigation. Alkali determinations are said to have rarely indicated the presence of more than a trace of salts.

Soil survey of Alcorn County, Mississippi, E. M. JONES and E. P. LOWE (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+673-705, pls. 2, fig. 1, map 1*).—This survey, made in cooperation with the Mississippi Geological Survey, deals with the soils of an area of 254,720 acres lying in the Coastal Plain in the northeastern corner of Mississippi. The surface ranges from gently rolling to hilly and rough, and drainage is well established in most places.

Including chalk, 26 soil types of 17 series are mapped, of which the Pheba silt loam, Ruston fine sandy loam, Collins silt loam, and Ruston stony fine sandy loam cover 26.7, 17.7, 11.6, and 10.2 per cent of the area, respectively.

Investigation of the nature of the soils of the Biesbosch in South Holland [trans. title], J. G. MASCHHAUPT and D. J. HISSINK (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 29 (1924), pp. 110-136, figs. 5*).—Physical and chemical studies of samples of soil taken from the Biesbosch in South Holland are reported, and the results are discussed and compared with polder samples.

These soils are evidently well supplied, especially in the top strata, with total nitrogen, phosphoric acid, lime, and organic matter, and have a slightly alkaline reaction. It is thought that after drainage they should possess a greater immediate cultural value than the polder soils.

A brief description of the analytical methods of study used is presented.

[Investigation of the Dollard soils of the Province of Groningen], J. G. MASCHHAUPT (*Bijdr. Kennis Prov. Groningen, n. ser., 1923, No. 2, pp. [4]+76, pls. 4, figs. 2*).—Studies of the soils of the Dollards of Groningen to determine the agricultural value of these diked-in soils are reported. Soil borings were made at about 70 different locations, and the samples obtained were studied in the laboratory. A large amount of comparative data is presented and discussed.

The natural and chemical changes which alluvial soils undergo after diking [trans. title], D. J. HISSINK (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta., No. 29 (1924), pp. 170-184*).—Studies of the physical and chemical properties of the alluvial soils of the Netherlands and of the natural and chemical changes which they undergo after reclamation by diking are reported.

The results show that these soils possess a large percentage of pore space which varies with the clay content, and they are naturally very pervious. When reclaimed and drained oxidation processes are rapid, resulting in the formation of carbon dioxide, and consequently calcium carbonate, which flocculates the soda clay and forms also calcareous clay. The physical condition of these soils is improved and the porosity increased.

Calculation of the coefficient of permeability of clay from the hydrodynamic pressure phenomena [trans. title], K. v. TERZAGHI (*Sitzber. Akad. Wiss. Wien, Math. Naturw. Kl.*, 133 (1923), IIa, No. 3-4, pp. 125-138, figs. 4; *abs. in Sci. Abs., Sect. A—Phys.*, 27 (1924), No. 322, pp. 853, 854).—Studies are reported in which it was found that in clay with a porosity number less than 2 and a coefficient of permeability greater than 0.06 cm. per year, there was no appreciable variation from the law of Darcy.

In an investigation to determine the coefficient of permeability of loam and of clay in the viscous-plastic and in the semisolid form, the direct method of measurement failed because the coefficient of permeability of the soils in this form was very small as compared with a coefficient of 0.06 cm. per year. A method was therefore developed to avoid the errors of the direct method, which consisted in the observation of the time change of the pressure phenomena in clay. The hydrodynamic pressure phenomena is considered to be the delay which is caused in clay in the pressure due to the resistance to the outflow of squeezed out water. It is stated that the permeability coefficient can be calculated from the time variation of the equalization of pressure as long as all other important factors are known.

With the help of diagrams, the case of a block of loam or clay of height h contained in a vessel which will prevent spreading is considered. As the pressure is increased the porosity number and the coefficient of permeability decrease, and a definite amount of water is squeezed out of the clay. The unit of volume is taken as a prism of unit sectional area. The length of the prism in the direction of the pressure is variable, the reduced thickness of the layer is the thickness which the layer would have if the porosity number were 0, and the coefficient of permeability denotes the velocity of flow of the water through a layer of clay of the real thickness when the difference of pressure height is 1 cm. The differential equation for the flow is exactly the same as that for the nonstationary propagation of heat in an isotropic medium. The solution of the equation is given, and the results for special cases are plotted. It is concluded that Darcy's law holds for the flow of water through loam in a semisolid form.

Heat of wetting as a new means of estimating the colloidal material in soils, G. J. BOUYOUCOS (*Science*, 60 (1924), No. 1553, p. 320).—In a brief contribution from the Michigan Experiment Station the conclusion is drawn that the heat of wetting presents probably the best means for estimating the colloidal content of soils as well as their state of activation. It has been found that the heat of wetting of soils is due mainly, if not entirely, to their colloids, as noncolloidal material even in a very fine state of division does not produce heat of wetting.

According to this method the colloidal content of soils may range from 0 to 80 per cent of their weight, and the average soil is found to contain a far larger amount of colloids than is commonly believed. It has been further found that the reactivity of material may not depend entirely upon the size of its particles but also upon the state of its activation. The procedure of the method consists of determining the heat of wetting of a soil, then extracting a certain amount of colloids from it and determining their heat of wetting, from which data the colloidal content is readily calculated.

The effect of drying upon the acidity of soil samples, C. O. ROST and E. A. FIEGER (*Science*, 60 (1924), No. 1552, p. 297).—Further studies conducted at the Minnesota Experiment Station on the effect of drying upon the H-ion concentration of about 200 samples of soils in both moist and air-dry condition (E. S. R., 50, p. 718) are summarized.

Samples from one field showed marked changes upon being allowed to become air-dry, those from two fields changed somewhat less but still appreciably, and those from the remaining two only slightly. Generally the H-ion concentration increased, but in a few instances it decreased. Where sufficient lime or marl had been added to make the soil alkaline, some samples showed no change in H-ion concentration, some an increase, and others a decrease upon air-drying.

A group of 92 glacial soils, partly acid and partly alkaline, were found after air-drying to be decidedly more acid than before, the alkaline soils, however, showing the more marked change. A group of loessial soils which were on the whole more acid than the glacial soils showed less change.

Oven-drying increased the H-ion concentration more than air-drying. Samples moistened after air-drying became more acid than the original moist samples and usually more acid than the air-dried samples. Moist samples kept in glass air-tight containers generally became more acid on standing. Air-dried samples showed a more acid reaction than moist ones freshly taken from the field.

A bibliography relating to soil alkalies, compiled by F. V. KING, G. ERVIN, and O. L. EVANS (*U. S. Dept. Agr. Bul. 1314 (1925), pp. 40*).—This bibliography was compiled under the direction of S. H. McCrory, with special reference to the deleterious action of soil alkalies and various other chemical agents on cement and concrete. It contains sections on soil alkalinity, alkali soil salts, sea water, other injurious agents, waterproofing of concrete, and alkali-resistant concrete.

Soil temperature determinations from April to October, 1924 [trans. title], J. HUDIG (*Landbouwk. Tijdschr. (Utrecht), 36 (1924), No. 434, pp. 420-424*).—Soil temperature determinations taken from April to October at depths of 50, 75, and 100 cm. (19.7, 29.5, and 39.4 in.) in Dutch soils are briefly presented and discussed. These show naturally that the temperatures decreased with depth, and all of them increased quite uniformly as the temperature of the air increased. However, the difference between the temperatures at different depths was much less marked at the end than at the beginning of the period.

The principles of summer-fallow tillage, M. A. MCCALL and H. M. WANSEER (*Washington Col. Sta. Bul. 183 (1924), pp. 6-77, figs. 5*).—The results of studies on the subject conducted in cooperation with the U. S. Department of Agriculture are summarized.

It is concluded that the summer fallow system is necessary in eastern Washington dry farming because of the seasonal distribution and amount of precipitation, the purpose being to conserve moisture and to accumulate nitrate nitrogen. Climatic conditions divide the fallow period into distinct subperiods, emphasizing either absorption or retention. The existence of a soil mulch during the fall and winter period of precipitation inhibits moisture absorption by the soil to a degree which is proportional to the depth of the mulch. A soil mulch during the summer period of intensive evaporation retains moisture already in the soil.

Early spring plowing was found to give the largest accumulation of nitrates, intermediate spring and fall plowing being from 10 to 15 per cent less efficient. Disking was less efficient than plowing in promoting nitrification.

There was a significant positive correlation between soil moisture and accumulated nitrate nitrogen and yield of straw and grain. There was a more significant correlation between grain yield and soil moisture content than between grain yield and nitrate nitrogen accumulations. Moisture conservation is therefore considered to be the most important function of the summer fallow

under the experimental conditions, although a proper balance between nitrate accumulations and soil moisture is necessary for best results. Fallow prepared during the intermediate spring was found most nearly to meet this requirement. There was a significant positive correlation between grain quality and accumulated nitrate nitrogen.

Chemical factors in denitrification, G. J. FOWLER and Y. N. KOTWAL (*Jour. Indian Inst. Sci.*, 7 (1924), No. 2, pp. 29-37, pl. 1).—Experiments to determine whether losses of nitrogen from stored nitrogenous materials through chemical causes occur under conditions comparable with those encountered in practice are reported. The general conclusion is drawn that the evolution and consequent losses of gaseous nitrogen, taking place in nature or in the operations of agriculture and sewage purification due to purely chemical causes, are negligible as far as the reactions investigated are concerned. The losses of nitrogen due to biochemical changes were found to occur in a great variety of ways.

Determination of fertilizer requirements of soils, E. A. MITSCHERLICH (*Die Bestimmung des Düngerbedürfnisses des Bodens*. Berlin: Paul Parey, 1924, pp. 99, figs. 7).—The details of different methods of determining the fertilizer requirements of soils are described, and the relation between these and the chemical composition and reaction of soils is brought out.

Special attention is drawn to the utility of pot and field fertilizer experiments in determining available fertility as well as fertility requirements of soils, and the proper interpretation of these is discussed.

Report of field experiments with fertilizers in Sweden in the years 1922 and 1923 [trans. title], H. VON FEILITZEN (*Meddel. Centralanst. Försöksv. Jordbruksområdet [Sweden]*, Nos. 259 (1924), pp. 415, figs. 12; 272, pp. 471, figs. 15).—A large amount of data from field experiments with fertilizers in Sweden during the years 1922 and 1923 is summarized, together with other general data in connection with this work, which was begun in 1900.

Fertilizer suggestions for crops under Pennsylvania conditions, F. D. GARDNER and A. L. PATRICK (*Penn. State Col. Ext. Circ. 102* (1924), pp. 8).—Practical suggestions on the use of fertilizers for crops in Pennsylvania are presented.

The influence of phosphate, biphosphate, carbonate, silicate, and sulfate of calcium, sodium, and potassium on plant growth in acid mineral soils, K. MIYAKE, I. TAMACHI, and J. KONNO (*Soil Sci.*, 18 (1924), No. 4, pp. 279-309, figs. 14).—Studies conducted at the Hokkaido Imperial University, Sapporo, Japan, are reported on the behavior of the phosphate, biphosphate, carbonate, silicate, and sulfate of calcium, sodium, and potassium on acid soils in connection with plant growth.

The acidity of the soils was reduced by the addition of carbonate, phosphate, biphosphate, and silicate of calcium, sodium, and potassium in the order mentioned, while sulfate did not make any reduction. The H-ion concentration of the soil solution also was reduced by the addition of these salts, but the order of the reduction did not coincide with that observed in the case of the acidity.

The amount of aluminum dissolved out in the solution of potassium chloride from the soils after the addition of these salts agreed well with that of the acidity. The acidity seems then to be due to the amount of aluminum in the solution. In their power to make soluble aluminum into insoluble, the salts ranked in their order, carbonate, phosphate, biphosphate, and silicate. Sulfate not only lacked this power but increased the amount of soluble aluminum. This order coincided with that of the reduction of acidity by the salts.

The growth of barley was affected by the addition of the salts. A favorable effect was produced by phosphate, biphosphate, carbonate, and silicate in the order mentioned, while the unfavorable effect was caused by sulfate. This order seemed to agree with that of the salts in converting soluble aluminum into insoluble, except that phosphate and carbonate were interchanged. Hence the aluminum abundantly present in acid soils seemed to be a very important factor causing inferior plant growth.

The superior effect of phosphate upon plant growth seemed to be due to the great deficiency of phosphoric acid in this kind of soil. Though the H-ion concentration of the soil solution also was reduced by the addition of the salts, it did not show any relation to the plant growth.

These results are taken to indicate that the inferior quality of the acid soil as a medium for plant growth is due in some measure at least to the presence of soluble aluminum, which is decidedly toxic, and to the deficiency of phosphoric acid. Hence the chemicals which supply phosphoric acid and cause the elimination of soluble aluminum seem to be the best agents for improving acid soils.

Nitrification of stable manure in cultivated soils [trans. title], C. BARTHEL and N. BENGTSSON (*Meddel. Centralanst. Försöksv. Jordbruksområdet [Sweden], No. 269 (1924), pp. 13*).—Studies on the influence of newly slaked lime, added in amounts corresponding to those used in practice, on the nitrification of barnyard manure are reported.

The results showed that lime used in normal quantities had no influence in this respect. It is concluded that lime added to the soil either in the form of calcium carbonate or as newly slaked lime and in amounts used in practice has no noteworthy effect on the nitrification of barnyard manure, and that the time of liming does not alter the results.

Influence of koufri, marog, and tafla on the physical properties of soil [trans. title], V. M. MOSSÉRI (*Bul. Inst. Égypte, 5 (1922-23), pp. 85-113*).—Studies are reported which showed that koufri, marog, and tafla, which are rich in salts of calcium, magnesium, or potassium, except potassium carbonate, decrease the air capacity and increase the moisture-holding capacity, capillarity, and permeability of heavy Egyptian delta soils, but slightly decrease the two last named in lighter alluvial soils.

Materials containing salts of sodium, especially sodium carbonate, acted in much the same manner on the capacity for air and moisture, but decreased the permeability and capillarity of both soils considerably. However, when sodium sulfate formed the major part of the salts the permeability of the heavy soils was increased. A high content of calcium sulfate or of this salt mixed with calcium chloride notably increased the permeability of both soils.

The availability of nitrogen in peat, C. B. LIPMAN and M. E. WANK (*Soil Sci., 18 (1924), No. 4, pp. 311-316, figs. 2*).—Studies conducted at the University of California on the value of peat as a source of nitrogen when applied to a soil which had always responded to nitrogenous fertilizers are reported.

The results showed that peat untreated or treated with acid and with acid plus steam under pressure is of practically no value as a source of available nitrogen when results from particular experiments carried on for this purpose are properly studied.

Nitrate facts and figures, 1924, compiled by A. F. B. JAMES (*London: C. Mathieson & Sons, 1924, pp. 15*).—A statistical review of the nitrate industry from the British viewpoint, for the year 1924 in particular as compared with previous years, is presented. The feature of the year under review is said to be the steady improvement in the statistical position of the commodity. Special reference is made to the Chilean nitrate industry.

Ammonium nitrate as an explosive, R. M. COOK (*Chem. and Metall. Engin.*, 31 (1924), No. 6, pp. 231-233, fig. 1).—Experiments are reported which are considered to offer striking confirmation of the impression that organic or carbonaceous materials even in small percentages have a marked effect on the sensitiveness of ammonium nitrate toward detonation.

Test of phosphatic fertilizers [trans. title], C. BRIOUX and A. TARDY (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 5, pp. 312-319, fig. 1).—Comparative tests of basic slag, superphosphate, dicalcium phosphate, and a Tunisian phosphate ground colloiddally fine showed that on grain crops such as oats the so-called colloidal phosphate had little beneficial influence, while on root crops such as potatoes it gave practically as good results as superphosphate.

Origin of phosphorite and the degree of its pulverization as principal factors in its assimilation by vegetation [trans. title], A. LEBEDIANTZEV (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 5, pp. 330-338, fig. 1).—Studies with five different sorts of Russian phosphorites are reported which showed that these vary in value, depending largely upon whether or not they can best be used in powdered raw form or in the manufacture of superphosphate. The fineness of the powder in the first use is of decisive importance, and the particles should not exceed 0.05 mm. The availability of the phosphoric acid of four of the five sorts tested was strongly influenced by the degree of pulverization.

Reciprocal action of ground phosphorite and soils not having an acid reaction [trans. title], A. N. LEBEDIANTZEV (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 5, pp. 320-329).—Studies of the activity of ground phosphorite in fallow and cropped soils are reported.

The results indicated the great importance of the biological activity of soil in modifying the availability of phosphorite. In the majority of cases the action of phosphorite added directly previous to planting was more pronounced than that of phosphorite added to fallowed and subsequently cropped soil.

The results are taken further to indicate that the phosphoric acid of phosphorite becomes available in soils much more easily than has hitherto been thought, but that it may again be rendered insoluble by chemical and biological action. Phosphorite was also found to be quite sensitive to the action of the desiccation, reacting more markedly to this influence than basic slag or superphosphate. Since desiccation apparently exercises its main influence on organic compounds in soils and has little influence on mineral compounds, it is thought that the greater part of the phosphoric acid of phosphorite passes into organic combination.

The results in general are taken to indicate that the phosphoric acid of phosphorite is inherently much more mobile under soil conditions than that of superphosphate or basic slag.

Agricultural liming materials (*Md. Univ. Quart. No. 109* (1924), pp. 24, figs. 2).—Actual and guaranteed analyses of 104 samples of various forms of agricultural lime products collected for inspection in Maryland during the year ended November 1, 1924, are presented and discussed, together with general information on the quarrying and manufacture of liming materials.

Report on commercial fertilizers, 1924, E. M. BAILEY (*Connecticut State Sta. Bul. 261* (1924), pp. 3-100).—Guaranties and the results of actual analyses of 592 samples of fertilizers and fertilizer materials collected for inspection in Connecticut during 1924 are summarized. The essential features of the State fertilizer law and the fertilizer registrations for 1924 are also included.

Commercial fertilizers, 1924, J. M. BARTLETT (*Maine Sta. Off. Insp. 113* (1924), pp. 37-68).—Guaranties and actual analyses of 392 samples of fertilizers

and fertilizer materials collected for inspection in Maine during 1924 are presented.

Commercial fertilizers, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul.* 240 (1924), pp. 3-24).—Guaranties and actual analyses of 382 samples of fertilizers and fertilizer materials representing 180 brands collected for inspection in Vermont during 1924 are summarized and discussed.

AGRICULTURAL BOTANY

Can the hydrogen ion concentration of living protoplasm be determined? G. W. SCARTH (*Science*, 60 (1924), No. 1558, pp. 431, 432).—The author claims that the various determinations that have been made of H-ion concentration in organisms are applicable in the case of plants only to the cell sap, and in the case of animals usually to the body fluids bathing the exterior of the cells. Based on a study of the ameba *Pelomyxa palustris*, which was filled with algae, diatoms, etc., he believes that the H-ion concentration of a vacuole can be no criterion of that of the protoplasm that surrounds it.

Iron supply in a nutrient medium, H. S. REED and A. R. C. HAAS (*Bot. Gaz.*, 77 (1924), No. 3, pp. 290-299).—In the course of an investigation on the growth of citrus trees and their absorption of materials from nutrient solutions, numerous cases of chlorosis appeared despite the fact that special attention was given to the supply of iron salts. Not all these cases of chlorosis could be correlated with insufficient iron, and they often appeared to be connected with nutritional disturbances due to the absence of other nutrient ions. Studies were undertaken to determine some of the conditions which affect the amount of soluble iron salts in nutrient solutions, the problem being considered as one of importance for the intelligent use of such solutions.

It is stated that the iron of ferric tartrate soon becomes converted into insoluble compounds when added to nutrient solutions, the change being more rapid in solutions of higher pH. The introduction of carbon dioxide lowers the pH of slightly acid, neutral, or alkaline solutions, but does not increase the solubility of iron compounds which they contain. The addition of certain organic compounds to an alkaline nutrient solution increases the amount of soluble iron in the solution. This fact may be of significance in maintaining an adequate supply of soluble iron in solutions for the growth of plants.

Biochemical aspects of fermentation, A. SLATOR (*Jour. Inst. Brewing*, 29 (1923), No. 10, pp. 814-818).—Chemical action due to microorganisms usually occurs chiefly during the growth and development of such organisms, giving a typical S-shaped curve of an autocatalytic reaction. To understand this curve it is necessary to know the factors determining and influencing both the growth and the fermentative activity of the yeast. In certain parts of this curve so many factors are changing simultaneously as to complicate its analysis. In the present paper a short account of these factors is given.

Chemical aspects of germination, J. L. BAKER and H. F. E. HULTON (*Jour. Inst. Brewing*, 29 (1923), No. 10, pp. 824-838).—This outline of the chemical aspects of germination deals mainly with previous work by others and admittedly includes only a few of the more salient features of the subject.

Temperature coefficient of absorption in seeds of corn, C. A. and S. P. SHULL (*Bot. Gaz.*, 77 (1924), No. 3, pp. 262-279, fig. 1).—A study of the influence of wide temperature differences on the rate of water absorption by seeds of corn has given results agreeing completely with those of a similar study of *Xanthium* seeds and pea cotyledons made previously (*E. S. R.*, 44, p. 728). The same type of formula and the methods of mathematical analysis used with other seeds were found to apply with great exactness to the data obtained

with corn. The rate of absorption at 50° C. is somewhat more than eight times as fast as at 5°, whereas the chemical theory of absorption would call for a rate 32 times as great. From mathematical considerations, the velocity of intake at any given moment must be considered as approximately an inverse exponential function of any amount of water previously absorbed. Attention is called to cases of irregular absorption rates, indicating that many substances have specific absorption behavior. A rate law with wide applicability is not to be expected. The importance of semipermeability with reference to the intake of water from solutions of various kinds is pointed out.

The rate of growth of green and albino maize seedlings, J. H. KEMPTON (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 6, pp. 311, 312, fig. 1).—In connection with observed differences in plants as to their response to temperature and solar radiation, a comparison was made of the elongation rate of albino seedlings with that of normal green ones. Little difference was observed in the size of the seedlings until they had produced three leaves, after which the green plants forged ahead and the albinos declined.

The growth curves were remarkably alike, both kinds of plants showing almost identical response to light and temperature. The author considers it remarkable that sister maize plants differing so greatly in a major physiological characteristic should have such similar growth rates. Such behavior is believed to show that the response of the plant to air temperature and radiation is controlled by inherent factors not associated with the production of chlorophyll and photosynthesis.

Influence of time of seeding of cereals on their vegetative rhythm [trans. title], G. MARTINET (*Ann. Agr. Suisse*, 24 (1923), No. 1, pp. 1-7).—Facts adduced in connection with the reactions of a number of wheats, and of this and other cereals in elevated regions, are said to show these to possess great power of adaptation in difficult situations endangering reproduction.

Growth of plants in artificial light.—II, Intensities of continuous light required for blooming, E. HENDRICKS and R. B. HARVEY (*Bot. Gaz.*, 77 (1924), No. 3, pp. 330-334, fig. 1).—Of a number of plants grown in the rooms described in a previous paper by Harvey (*E. S. R.*, 51, p. 25) and subjected to continuous artificial illumination, some showed growth and blooming throughout a wide range of intensities, others through a limited range only. A speeding up of the blooming of Easter lilies was correlated with an increase in the carbohydrate content of the leaves when grown in continuous artificial light.

Studies on the effects of air temperature and relative humidity on the transpiration of *Pinus strobus*, E. J. DOLE (*Vermont Sta. Bul.* 238 (1924), pp. 3-39, pls. 2, figs. 11).—The results are given of studies on the effects of air temperature and relative humidity on the transpiration phenomena in the white pine, comparisons being made with transpiration in an uncontrolled environment, with plants deprived of their normal period of rest, and as influenced by soil conditions.

The author's results show that environment influences the hourly fluctuation in transpiration, and the previous environmental condition influences the rate of transpiration when grown under control conditions. Within the limits of the experiment the author found that the amount of available soil water had an important bearing on the transpiration, and that soil conditions, as well as atmospheric conditions, must be controlled. It is claimed that absolute transpirational losses can not be correlated either with relative humidity or with temperature, nor can they be correlated with the combined effect of these two factors as expressed in terms of vapor pressure. The products of actual losses and vapor pressure, it is said, may be correlated with temperature, which implies that temperature has an additional influence on the phenomenon

other than its influence in determining the value of vapor pressure. In an unchanging environment the phenomena of transpiration and evaporation were found to be closely parallel.

A bibliography of literature on transpiration is given.

Comparative studies on respiration.—XXI, Acid formation and decreased production of CO₂ due to ethyl alcohol, M. IRWIN and M. WEINSTEIN (*Amer. Jour. Bot.*, 9 (1922), No. 6, pp. 277–282, figs. 2).—Ethyl alcohol decreases the production of carbon dioxide by radish seedlings, and at the same time brings about the formation of organic acids.

Comparative studies on respiration.—XXII, The effect of lactic acid on the respiration of wheat, E. P. SMITH (*Amer. Jour. Bot.*, 9 (1922), No. 6, pp. 307–310, figs. 2).—In high dilutions, as 0.0025 M, lactic acid first accelerates and then depresses the rate of production of carbon dioxide by wheat seedlings. As the concentration of the acid increases, the preliminary rise in rate becomes less marked, until a concentration is reached at which the rate begins to fall. Even if the rate has been rapidly reduced to 25 per cent of the normal by 2 M lactic acid, recovery is possible and appears to be complete. The observed effects are due not merely to osmotic pressure or to acidity, but to some specific action of the lactic acid.

Since there is no permanent increase in the rate of production of carbon dioxide, as would be expected on the hypothesis that lactic acid is a stage in the metabolism of wheat, it is concluded that lactic acid is not, in this case, an important intermediate substance.

Comparative studies on respiration.—XXIII, The effect of adrenalin on the production of carbon dioxide by animals and by plants, D. M. HUTCHINSON (*Amer. Jour. Physiol.*, 62 (1922), No. 2, pp. 192–196, figs. 2).—The action of adrenaline on the production of carbon dioxide as measured by the apparatus previously described by Osterhout (*E. S. R.*, 41, p. 524) shows that adrenaline gives similar effects on the respiration of frog's muscle and on that of radish seedlings. The stronger solutions (0.002 to 0.003 per cent) cause a depression. This is followed by a return to normal, probably due to the oxidation of the adrenaline. Weaker solutions produce a rhythmic effect, the carbon dioxide production rate alternately and repeatedly falling and rising.

Assimilation-respiration balance as related to length of day reactions of soy beans, F. M. EATON (*Bot. Gaz.*, 77 (1924), No. 3, pp. 311–321, figs. 4).—The somewhat preliminary experiments here recorded were planned to ascertain whether the daily balance between assimilation and respiration might not prove to be a controlling influence determining plant development as to its vegetative or reproductive form.

The time of flowering of Peking soy beans given high, low, and uncontrolled nightly temperatures was affected to an extent comparable with the differences brought about by varying the length of day. It was found that respiration proceeded almost twice as rapidly under hot night conditions as under cold night conditions. Depriving soy beans of carbon dioxide for a part of the day did not affect the time of blooming. Not all short-day plants gave the same reactions to varied nightly temperatures. Elongation of maize during the night was found to be nearly proportional to the temperature.

Effect of ethylene upon respiration of lemons, F. E. DENNY (*Bot. Gaz.*, 77 (1924), No. 3, pp. 322–329, figs. 2).—In experimentation started by the laboratory of fruit and vegetable chemistry, Bureau of Chemistry, U. S. D. A., to determine the gaseous constituent of the sweat room atmosphere effective in coloring lemons, it was found that ethylene was very effective, 1:1,000,000 turning green but mature lemons yellow in from 6 to 10 days. These experi-

ments also showed high ethylene concentrations (80 per cent), high temperatures (92° F.), low temperatures (45° F.), and lack of oxygen to prevent or greatly check the coloring action. Conditions suitable for the life processes of the fruit favored the color change. Coloring with ethylene or gas from kerosene stoves caused loss of the buttons (calyx, receptacle, and part of the peduncle), with enlargement and gelatinization of the absciss-layer cells. It is supposed that secondary growth had set up here at least, producing a condition in lemons analogous to the extrusion of tissue on stems of plants mentioned by Doubt (E. S. R., 37, p. 726). These facts indicated that ethylene in some manner stimulated the growth or the life processes of the cells of the fruit, probably increasing respiration. The results of the measurements of the carbon dioxide output of ethylene-treated lemons as compared with those receiving no ethylene are here recorded.

Ethylene in air at concentrations of 1:1,000, 1:10,000, 1:100,000, and 1:1,000,000 increased the respiration of green lemons. The effect appeared to be greatest at the intermediate concentrations. The increase in carbon dioxide output ranged from about 100 per cent to about 250 per cent, followed by a decrease on discontinuance of the ethylene applications. Yellowing of the ethylene-treated fruit became apparent about the third or fourth day, the full yellow color developing in from 6 to 10 days, and untreated fruit remaining green.

The development and nutrition of yeast, [I], II, A. TAIT and L. FLETCHER (*Jour. Inst. Brewing*, 28 (1922), No. 8, pp. 597-621, figs. 2; 29 (1923), No. 7, pp. 509-537, figs. 7).—Besides particulars having more technical bearings which are brought out by this investigation, the authors point out in the first paper the comparative insufficiency of asparagine as a nitrogen source, the influence of acidity on yeast growth, the importance of pH in brewing, the inadequacy of ammonium salts as food for *Saccharomyces cerevisae*, the relationship between the fermentative power and nitrogen content of yeast under certain conditions, and a distinct relationship between the initial nitrogen content of worts and the amount of yeast produced, at least at the lower nitrogen concentrations.

In the second paper they state that there is practically no difference in the relative values of the nitrogenous constituents of malt rootlets and malt worts as yeast food. Worts or artificial nutrient solutions when aerated by standing for 48 hours at room temperature contain sufficient oxygen for the normal reproduction of yeast. Continuous aeration does not influence the rate of reproduction under the conditions herein laid down. Carbon dioxide should not be used to displace the air above fermenting solutions since this gas retards distinctly yeast multiplication. At a concentration of about 0.7 per cent alcohol with the carbonic acid retained in solution, there is a marked retardation in the rate of yeast reproduction. Except in the very early stages, the alcohol formation and the yeast multiplication rate do not follow the same exponential law. Owing to the variation in weight of cells during fermentation general conclusions can not be deduced from the weights of final crops. Preferable methods are the determination of the nitrogen coefficient or direct counting, the latter of which is the more reliable.

Origin of prairies in Illinois, J. WOODARD (*Bot. Gaz.*, 77 (1924), No. 3, pp. 241-261).—The prairies of Illinois are shown to be near the eastern edge of an eastern extension of the prairie province of the United States and Canada (which is outlined). They are said to lie really in a region having a woodland climate, the reasons for which fact are presented in connection with the apparent geological and later vegetal history of the region.

Age and area: A review of J. C. Willis' theory of the origin of species, H. DE VRIES (*Jour. Heredity*, 14 (1923), No. 4, pp. 165-170).—A review is given of Willis' theory of the origin of species as embodied in the book previously noted (E. S. R., 51, p. 821).

GENETICS

[Plant breeding activities at the Dahlem Station], HÖSTERMANN (*Ber. Höher. Gart. Lehranst. Berlin-Dahlem*, 1922-1923, pp. 32-38).—Selfing tests with the Berner Rosenapfel and Baumann Renette apples and the Liegel Winterbutterbirne pear showed these varieties to be nonautogamous. Gooseberries, on the other hand, lent themselves readily to self-fertilization. *Juglans cordiformis* was successfully crossed with *J. regia* in an attempt to develop hardy, productive types of hybrids. No evidence was obtained in garden pea hybridization to show that the male parent exerts an immediate influence on the first generation. Crosses between *Papaver somniferum* and *P. orientale* showed that the color and productivity of the latter species is dominant in the F_1 generation. Work with the garden stock, *Matthiola annua*, indicated that the first seeds to germinate carry a higher proportion of double flowered plants than do the later seeds.

Triploidy in the tomato, J. W. LESLEY and M. C. MANN (*Science*, 61 (1925), No. 1573, p. 208).—A cytological examination of root tip cells of an abnormal, unfruitful plant appearing in a Dwarf Aristocrat population showed 36 chromosomes, as compared with 24 for typical, normal plants. Both in the greenhouse and the field flowers of the abnormal plant were found to contain a considerable proportion of sterile pollen. While the pollen grains of the abnormal plant were similar in average size to those of normal plants, the variability was much greater. Progeny raised from the variant included some plants containing an extra number of chromosomes.

A dominant lethal chlorophyll mutation in maize, J. H. KEMPTON (*Jour. Agr. Research* [U. S.], 29 (1924), No. 6, pp. 307-309).—The author gives an account of the elimination of a dominant mutation that appeared in studies of maize. In a population of 50 plants of an F_1 between two varieties of maize there appeared a single plant, one half of which was normal green in color, the other half being yellow. The plant as a whole was a perfect example of a sectorial chimera. Pollen taken from the two halves of the plant in question was applied to normal green plants, and the cross having the green side of the chimera as the male parent gave only green seedlings in F_1 and F_2 progeny, while the cross having as a male parent the yellow side of the chimera gave equal numbers of yellow and green plants in the F_1 . The green plants gave only green in the F_2 generation and the yellow plants died in the field. It is concluded that the yellow character represents a dominant mutation that is lethal under field culture.

An hereditary intra-uterine developmental deficiency in the dominant white mouse, S. B. DE ABERLE (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 177, 178).—The occurrence of an intrauterine anemia in fetuses over 16 days of gestation is noted in dominant white mice from the Stanford Medical School. The anemia causes death in the young within 5 days after birth. In crosses with recessive white mice, this abnormality has been found due to a recessive Mendelian factor not carried by recessive whites.

A sterile hybrid of spelt and rye [trans. title], L. BLARINGHEM (*Compt. Rend. Acad. Sci. [Paris]*, 175 (1922), No. 16, pp. 635-637).—A crossing, accomplished in 1921, between *Triticum spelta* and *Secale cereale* is noted, with an

account of certain characters of the resulting hybrid progeny, as xenia, vigor, structure, and florescence.

Some natural violet hybrids of North America, E. BRAINERD (*Vermont Sta. Bul.* 239 (1924), pp. 3-205, figs. 90).—In continuation of a study of the species of North American violets (E. S. R., 47, p. 526), the author describes 82 hybrids that were found growing naturally. The hybrids are considered to have originated through the natural crossing of 30 species. The probable origin of each hybrid, its distribution, and leading characteristics are described.

In an introduction by G. P. Burns, it is stated that while the new forms arising from the natural hybrids may show, in general, a separation in accordance with Mendelian principles, an example of pure segregation of characters was not found. The hybrids always showed to a greater or less extent a blending of the characters of the parents.

The shape and weight of eggs in relation to the sex of chicks in the domestic fowl, M. A. JULL and J. P. QUINN (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 4, pp. 195-201).—This is a report of a statistical study conducted in the Bureau of Animal Industry, U. S. D. A., dealing with the relation of the length, breadth, and weight of eggs to the sex of the chicks at hatching. The results are based on length and breadth measurements of 990 eggs of 24 Barred Plymouth Rock pullets and weights of 418 eggs of Barred Plymouth Rock females mated with Rhode Island Red males and 226 eggs of Rhode Island Red females mated with Rhode Island Red males.

The results were uniformly negative, the following table showing the similarity of the measurements and weights of the eggs developing into males and females:

Constants of eggs hatching into males and females

	Mean length	Mean length-breadth index	Mean weight Rock×Red hatched	Mean weight Rock×Red died in shell	Total mean weight Rock×Red	Mean weight Red×Red hatched	Mean weight all eggs
	<i>Mm.</i>		<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>	<i>Gm.</i>
Males.....	55.31±0.06	75.17±0.09	58.64±0.19	57.56±0.44	58.49±0.17	58.06±0.26	58.24±0.14
Females.....	55.42±.07	75.09±.10	58.53±.21	57.82±.43	58.45±.19	57.29±.27	58.01±.16
Difference..	.11±.09	.08±.13	.11±.28	.26±.61	.04±.25	.77±.37	.23±.21

Studies on the sex-ratio and related phenomena.—III, Note on the influence of size of litter, A. S. PARKES (*Ann. Appl. Biol.*, 10 (1923), No. 2, pp. 287-292, fig. 1).—The author reports a study of the effect of size of litter on the sex ratio in swine.

Based on 982 litters, comprising 7,932 individuals, recorded in volume 67 of the National Duroc-Jersey Record, the numbers of males per 100 females in the litters of from 4 to 12 pigs, were, respectively, 131, 135, 105, 112, 99, 101, 105, 125, and 107. The works of other investigators along similar lines are reviewed.

The preceding study of this series has been noted (E. S. R., 51, p. 634).

Studies on the sex-ratio and related phenomena.—IV, The frequencies of sex combinations in pig litters, A. S. PARKES (*Biometrika*, 15 (1923), No. 3-4, pp. 373-381, fig. 1).—A statistical study of the sex ratios in different sized litters of pigs has been made, using the 2,020 litters recorded in volume 67 of the National Duroc-Jersey Record as the basis for the study.

The tabulated material showed that there were 50 per cent or slightly more males in litters of 2, 3, 4, 12, 13, and 14, but less than 50 per cent males in the

litter sizes of 5 to 11, inclusive. The data have been studied by various statistical methods, and among the conclusions derived are the following: "The analyses here given show that in pigs the mean sex combinations have a greater than probable frequency, while the litters approaching to unisexuality have a less than probable frequency, a finding very hard to interpret."

Studies on the sex-ratio and related phenomena.—V, The sex-ratio in mice, and its variation, A. S. PARKES (*Brit. Jour. Expt. Biol.*, 1 (1924), No. 3, pp. 323-334, figs. 2).—The results of a study of the sex ratios among mice are reported for the stocks raised by the author at University College, London.

The sex ratio of the 1,031 mice born was 118 males to 100 females. The breeding of the young was carefully controlled so that the mother did not become pregnant during lactation. Season was found to have some effect on the sex ratio, as young born from March to June consisted of slightly less than 50 per cent males while there were 56.5 per cent males among those born from July to October. Small litters (1 to 4) had a low sex ratio of 45.5 per cent males, while among large litters (9 to 12) there were 55.6 per cent males. The first litters of females averaged 55.4 per cent males, while subsequent litters averaged 60 per cent.

The author has endeavored to explain the deviation from equality in the sex ratio on the basis of the chromosome theory of sex determination and sexual selective prenatal mortality.

An undescribed constituent of semen, P. A. FISH (*Abs. in Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 566, 567).—The presence of many very minute particles, probably of a fatty nature, in semen of various animals and man has been observed with the dark field microscope at the New York State Veterinary College. Spermatomicrons is suggested as the name for these particles. In fresh specimens the spermatomicrons are apparently embedded in a gelatinous matrix which becomes liquified with age, at which time the particles exhibit Brownian movement. Wide variations in the numbers of the spermatomicrons in the semen of the different classes of animals, and even in different individuals of the same class, have been observed. Similar particles called galactomicrons have been observed in the milk of various species of animals, but have not been found in other secretions of the body such as saliva, urine, and bile.

The effect of pregnancy upon postpubertal ovogenesis, E. ALLEN and B. ATCHESON (*Abs. in Anat. Rec.*, 27 (1924), No. 4, p. 178).—By making serial sections of the ovaries of mice killed at daily intervals during pregnancy, it was found at the University of Missouri that pregnancy greatly inhibits the occurrence of mitosis in the germinal epithelium (first stage of postpubertal ovogenesis), but did not prevent its occurrence more frequently at the seventh, fourteenth, and twenty-first days of pregnancy than at other times.

Selective elimination of ova in the adult ovary, E. ALLEN, W. B. KOUNTZ, and B. F. FRANCIS (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 178, 179).—Ovaries of sows have been found to contain an average of 45 visible follicles smaller than 3 mm. in diameter two weeks before ovulation, but the average number ovulated is only 6.5, indicating an elimination of 85 per cent. The 6.5 follicles attaining maturity are considered the metabolic equivalent of the 45 smaller ones. The presence of the large numbers of follicles from 10 to 14 days before oestrus insures a proper secretion of the follicular hormone over a considerable portion of the oestrous cycle. It is suggested that prenatal mortality may be considered as a continuation of preovulation mortality.

Polynuclear ova and polyovular follicles in the opossum, C. HARTMAN (*Abs. in Anat. Rec.*, 27 (1924), No. 4, p. 182).—The relatively common occurrence of ova having more than one germinal vesicle due to fusion of the germ

cells and the occurrence of polyovular follicles have been observed in 200 opossum ovaries examined at the University of Texas. The polynuclear ova are doomed to die, while the polyovular follicles become atresic and thus have no relation to fertility.

Correlations of external signs and vaginal changes with the ovarian cycle in swine, F. F. MCKENZIE (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 185, 186).—The external characteristics and vaginal changes during the oestrous cycle in swine are briefly described and correlated with ovarian changes. Large follicles were present during oestrus, but the follicles had ruptured two days after oestrus and innumerable follicles less than 1 mm. in diameter were present in the ovary. Ten days after oestrus from 41 to 42 follicles of an average diameter of 3.8 mm. were observed, while at 12 days after oestrus 22 to 23 follicles of an average diameter of 4.4 mm. and at 15 days after oestrus 17 follicles having an average diameter of 5.6 mm. were present. Thus, as the size of the follicles increases their number seems to decrease.

An inhibition in ovulation by the intraperitoneal injection of anterior hypophyseal substance in the domestic fowl, A. T. WALKER (*Abs. in Anat. Rec.*, 27 (1924), No. 4, p. 190).—Intraperitoneal injections into laying hens of extracts of the fresh anterior lobe of the hypophysis have been found, at the University of California, to immediately stop laying for from 1 to 4 weeks after the injections were discontinued. On post-mortem examination it was found that the ovaries were smaller than normal and that no large ova were present. All except the smaller follicles were undergoing atresia, and the yolk mass was being replaced by lutein tissue.

The corpus luteum of the oestrous cycle in the ox ovary.—Preliminary report, G. W. McNUTT (*Abs. in Anat. Rec.*, 27 (1924), No. 4, p. 211).—Ovulation in cows in which copulation was not permitted has been found, in studies at the Iowa State College, to occur in from 30 to 65 hours after the onset of heat. The follicle shrinks from a diameter of from 16 to 19 mm. to one of from 6 to 7 mm. with ovulation. Lutein cells are formed from both granulosa and theca interna. Vascularization starts immediately after ovulation and is practically complete in 9 days. There appears to be no relation between the size of the follicles which rupture and the size of the corpora lutea which develop in successive oestrous periods.

The cyclic changes of the tubular part of the genitalia of ox during the oestrous cycle.—Second paper, H. S. MURPHEY (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 213, 214).—Brief notes on the histological changes in the vagina, uterus, and tubes of the cow during the oestrous cycle are given, as observed at the Iowa State College.

Studies of the oestral flow of the pig, B. A. ZUPP (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 224, 225).—Brief notes are given on the nature of the secretions of the genital organs of the sow during oestrus, as observed at the Iowa State College.

A method of determining the prenatal mortality in a given pregnancy of a mouse without affecting its subsequent reproduction, E. C. MACDOWELL ET AL. (*Anat. Rec.*, 27 (1924), No. 5, pp. 329–336).—A description is given of a simple operation for making counts of the corpora lutea in the ovaries of pregnant mice a few days before parturition, for a determination of prenatal mortality. The count is made by carefully drawing the ovary out through an incision in the abdominal wall, the corpora lutea readily being recognized at this stage of pregnancy.

The results with females, many of which were operated on in this way for several successive litters, indicated that the operation had no influence on the number of young born alive or on the size of subsequent litters. In 136

operations 33.9 per cent of the ova that came to maturity were not represented by living young.

The effect of light doses of alcohol upon the estrus cycle, and on the number of corpora lutea and prenatal mortality in the mouse, E. C. MACDOWELL (*Abs. in Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 480-485).—In a study at the Carnegie Institution laboratory at Cold Spring Harbor, L. I., it was found that the daily treatment of mice with alcohol for 45 minutes did not affect the age of the opening of the vagina, the age of the occurrence of the first oestrus, the length of the oestrous cycle, the number of corpora lutea per ovulation, prenatal or natal mortality, or number of living young per litter. The corpora lutea counts in these mice were made by the method described in the above paper. The average corpora lutea counts per pregnancy were 9.95 for treated females and 9.9 for controls. Equal numbers of living young were born per litter by control and treated females, 5.79.

Deficiency effects in guinea-pigs, A. W. MEYER (*Abs. in Anat. Rec.*, 27 (1924), No. 4, pp. 211, 212).—Observations extending over nearly a decade at the Stanford Medical School indicate a lowered birth rate in guinea pigs from November to March. The occurrence of a bronchopneumonic infection in two different years caused considerable losses in the stocks, but the addition of tomato juice to the ration of weakened animals showing motor disability improved their vigor and appetite and made them more resistant to epidemics. It is suggested that the lowered vitality of the guinea pigs during the winter season may account for the reduced fecundity.

FIELD CROPS

Growth of corn and sunflowers in relation to climatic conditions, W. F. HANNA (*Bot. Gaz.*, 78 (1924), No. 2, pp. 200-214, figs. 4).—In an investigation in the department of field husbandry, University of Alberta, early seedlings of Mammoth Russian sunflowers germinated and appeared above ground sooner than early seedlings of Northwestern Dent corn, while late seedlings of both plants required about the same time. The corn was retarded more than the sunflowers by the low soil temperatures obtaining early in the season. A temperature of 29° F. in the spring of 1920 injured the corn but did not affect the sunflowers, and in 1921 a temperature of 24° killed the corn and slightly injured the sunflowers.

The growth of both corn and sunflowers showed closer correlation with temperature than with any other single climatic factor. The fact that corn gave the best correlation with temperature when remainder indices derived from temperatures above 10° C. (40° F.) were employed, while sunflowers gave the best correlation with temperatures above 0°, appeared to indicate a greater capacity in sunflowers than corn for growth at low temperatures. Physiological temperature efficiency indices derived from Lehenbauer's observations on the growth of maize seedlings (*E. S. R.*, 32, p. 334) showed no relation to the growth of sunflowers, but gave a distinct correlation with the growth of corn. While insufficient soil moisture in 1921 was undoubtedly responsible for the low yields of sunflowers in that year, corn showed no reduction in yield due to this cause.

Consideration of the climatic data, growth measurements, and yields for 1920 and 1921 indicated that corn promises to give better yields of fodder than sunflowers in areas with a comparatively long growing season, high temperatures, and limited soil moisture. Sunflowers should be well suited to sections where moisture is more abundant, with low temperatures at the begin-

ning and end of the growing season, and where there is danger from spring and fall frosts.

Fall seeding of spring crops [trans. title], N. I. PUSHKAREV (*Izv. Opytn. Dona i Sev. Kavkaza* (Jour. Agr. Research Don and North Caucasus) No. 3 (1923), pp. 19-40, fig. 1).—Varieties of crops normally sown in the spring were planted in September, October, and November at Rostov, which is located in a region bordering on the zone of continuous vegetation. Corn, beans, flax, poppies, and mustard did not live through the winter, and so few individuals of oats, millet, soy beans, peas, and sugar beets survived that their yields were insignificant. However, Sudan grass and hemp passed the winter in such numbers and with such vigor that hemp gave normal yields. Sorghum, cowpeas, and lentils produced thin stands and only average yields.

Late fall seeding seemed conducive to better stands, and plants passing through the winter successfully were characterized by a greater vigor than spring sown plants. Fall seeded spring wheat and sunflowers made 23 and 51 per cent, respectively, more grain and seed than the same varieties spring sown, and the sunflowers produced 44 per cent more oil per unit area. Fall sown *Abutilon avicennae* made greatly enhanced yields of stalks and seed.

Irrigated pastures, D. HANSEN (*Montana Sta. Bul.* 166 (1924), pp. 2-12, fig. 1).—Based on experiments made in cooperation with the U. S. Department of Agriculture at the Huntley Substation during 10 years, methods are recommended for establishing and maintaining irrigated pastures in southern Montana. The carrying capacity tests with dairy cattle reported are reviewed on p. 678.

Good stands were obtained by spring seeding mixtures alone, with a nurse crop of wheat cut for grain or for hay, and by late summer seeding in wheat stubble. However, the spring seeded plats were better established and in better condition for grazing during the season after seeding and produced more when harvested for hay. Late summer seeding resulted in good stands but with light growth during the next season and is recommended mainly if spring seeding fails. While seeding with a nurse crop gave good stands, its success depends largely upon favorable weather and requires that the grain be removed immediately after harvest in order to irrigate the grasses.

The Rieti Experiment Station for Cereals [trans. title], MAYLIN (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 5, pp. 339-351, pls. 3).—The activities and productions of the experimental station for cereal culture at Rieti, Italy, under the direction of N. Strampelli, are detailed, with a descriptive list of 33 varieties of wheat developed at this station.

Corn in Connecticut, D. F. JONES, W. L. SLATE, JR., and B. A. BROWN (*Connecticut State Sta. Bul.* 259 (1924), pp. 381-470, figs. 67; also *Connecticut Storrs Sta. Bul.* 124 (1924), pp. 309-396, figs. 66).—Nearly 150 varieties and strains of flint and dent corn were grown in comparison at Mount Carmel and at Storrs for various periods between 1914 and 1922, in a joint project between the Connecticut State and Storrs Stations. The varieties are described with notes on their origin, and according to their apparent adaptation certain varieties are suggested for five arbitrary districts in the State.

The highest yielding flints at both places included Mammoth White, Rhode Island White, and Sanford White; Bacon and Purdy Gold Nugget; Burwell Yellow, Frost Yellow, Skilton Yellow, and Zwick Yellow; Behan, Keeler, and Mosher strains of Longfellow; Bissel Yellow Dutton, U. S. No. 193, and Pied Flint. Among the most productive dents were Beardsley, Lanterman, and Vinehill strains of Leaming; Century, Dowd, Early Michigan, Herr White Cap, Lakeside, Luce Favorite, Northern White, Silver King, Sutton, Tryon,

and Webber Dent. Silage varieties of merit embraced Beardsley Leaming, Fureka, Funk 90-Day, Klondyke, Lakeside, Mastodon, and Northern White Dent.

On the average, dent varieties required a longer growing season than flints and yielded more grain and stover. When dent and flint varieties maturing in the same length of time were compared, the dents seemed somewhat more efficient as grain producers, but they did not always ripen as satisfactorily as the flints. In some seasons the highest yielding flint varieties surpassed the highest yielding dents at both places. No difference in the yield of yellow and white dent or flint varieties was observed.

What is the relation between the moisture content and viability of seed corn when subjected to low temperatures? W. SCOTT (*Iowa Acad. Sci. Proc.*, 30 (1923), pp. 254-262).—An experiment wherein corn with a high germination and various moisture contents was subjected to -12° C. (10.4° F.) for from 12- to 72-hour periods gave indications that the percentage of germination decreases as the moisture content rises above 30 per cent where a constant temperature of -12° is maintained longer than 12 hours. Practically no germination took place when the moisture content of the frozen corn had been much above 35 per cent. Seeds showing no injury under such conditions probably owed their power of resistance to impermeable or partly impermeable seed coats.

Cotton experiments, 1924, R. R. CHILDS (*Ga. Agr. Col. Circ.* 104 (1925), pp. [4]).—Strains of College No. 1, Cleveland, and Express produced the highest acre yields and value in the 1924 variety tests. Fairly close spacing made the highest yields in spite of extremely dry weather. While bolls were slightly smaller in unthinned rows and in 7-in. spacings, no appreciable difference was found in length or percentage of lint in the different spacings. In all spacings, two plants per hill gave higher yields than one plant. Acid-delinted seed germinated earlier and produced a better stand than untreated seed in 1924.

Cotton in Australia, R. HARDING (*London and New York: Longmans Green & Co.*, 1924, pp. XVIII+270, figs. 64).—The possibilities and the limitations of Australia as a cotton growing country are set forth in this volume, which includes an historical account, describes present and potential production and climatic, soil, and agricultural conditions in the regions best suited to the crop, and outlines seed control and cultural methods. Notes on cotton diseases, a summary of the life history of cotton in Egypt, and rainfall data are appended.

Studies of gambo hemp [trans. title], W. A. HORST (*Faserforschung*, 4 (1924), No. 2, pp. 61-124, pls. 8, figs. 9).—The botanical relations and nomenclature of *Hibiscus cannabinus* are discussed, with accounts of investigations of the microscopic, physical, chemical, and textile characteristics of its fiber, known as gambo hemp or bimli hemp, in comparison with jute and similar fibers. The culture requirements of *H. cannabinus* are outlined, and a note on *Crotalaria usaramoensis* and its fiber, said to be very similar to sunn fiber, is appended.

The fiber of *H. cannabinus* is similar to jute and can be used for textile purposes. The flowers are largely dependent upon self-fertilization. The fiber length is somewhat greater than that of genuine jute, and the fiber cells are generally somewhat longer, broader, and thicker walled than jute cells and differ therefrom in the ends. Fiber of *H. cannabinus* is somewhat less lignified than jute fiber but is similar in its content of water, ash, and cellulose. The weight of the bark, which consisted of from 30 to 50 per cent of fiber, constituted about one-third of the weight of the stalk in one of the varieties. The fiber content of the stalks is greater than that of hemp stalks.

Results of experiments with oats in New York, H. H. LOVE and W. T. CRAIG (*New York Cornell Sta. Bul.* 436 (1925), pp. 24, figs. 8).—Experiments with oats conducted in cooperation with the U. S. Department of Agriculture since 1914 are summarized. Earlier work has been noted (E. S. R., 31, p. 434).

Comparative tests with numerous oats varieties during several years showed that the selected strains are superior to the commercial varieties now on the market. The behavior of individual selections from National oats indicated the possibilities of gain through selection. The tabulations show State Selection 133-46, Cornelian, and National Selection 127-9 to be outstanding.

According to the averages early oats yield less than medium or late oats. Side oats are not considered good oats for the State; they are outyielded by the spreading panicle type and neither fill nor tiller well. Weight per bushel was not indicative of the value of a variety, whereas the percentage of kernel appears to be an important character. The fact that Cornelian had a very high percentage of kernel in addition to its yielding power makes it a very desirable variety of oats. With well prepared land and well cleaned seed, a seeding rate of 2.5 bu. per acre seemed adequate.

Variation in vigor of sprouts from quarters of single tubers, J. BUSHNELL (*Bot. Gaz.*, 78 (1924), No. 2, pp. 233-236, fig. 1).—Early Ohio potatoes from cold storage were quartered along the longitudinal axis and planted under uniform conditions at the Minnesota Experiment Station. A marked variation was seen in the time of appearance above the soil of the sprouts from the four pieces of the same tuber. There was an equally striking variation in the vigor of sprouts, the more vigorous sprouts generally being first to appear. The vigor of the sprout was directly correlated with its position on the seed piece. All of the small plants were attached at the tip or near the edge of the seed pieces, while the larger plants arose from more centrally located buds. Plants arising near the edge or at the tip apparently were unable to draw upon the reserve foods of the tuber as successfully as sprouts more favorably located. The stronger sprouts consistently produced the larger plants.

Depression of check-row yields by adjoining high yielding plot rows in potatoes, G. W. MUSGRAVE (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 10, pp. 633-635).—In a size-of-seed experiment with potatoes carried on by the New Jersey Experiment Stations, single row test plats were alternated with check plats. Although the depression of the check yield by the adjoining high yielding plat rows was slight, it suggested that competition existed in the cases cited. This was indicated by the high negative correlation coefficient, -0.6526 ± 0.1914 , as found by comparing the respective check yields with the average of the adjoining plat yields.

Synonyms of varieties of potatoes with a list of the distinct varieties tested at the potato testing station, Ormskirk, from 1915-1924, R. N. SALAMAN (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 39-53).—These pages include a list of about 480 distinct varieties of potatoes with wart immunity indicated, and a list of about 780 synonyms (E. S. R., 46, p. 730), each with its particular variety designated.

Report of the potato synonym committee on the potatoes sent for immunity trials to the potato testing station, Ormskirk, Lancashire, 1923, R. N. SALAMAN ET AL. (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 29-38).—The results of examinations of 307 varieties are reported, with comment on the presence of wart disease.

Observations on the time of blooming of rice flowers, J. W. JONES (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 10, pp. 665-670).—Observations made on a number of early and late short grain and late long grain varieties of rice at the Biggs (Calif.) Rice Field Station (E. S. R., 49, p. 433) disclosed that over

three-fourths of the rice flowers studied bloomed between 12 m. and 2 p. m., and that more flowers bloomed between 2 and 4 p. m. than between 10 a. m. and 12 m. Varietal differences appeared to have some influence on the time of blooming, fewer flowers of Shinriki blooming before 12 m. and more after 2 p. m. than was the case with Omachi and Wataribune. Many more flowers of the long grain varieties, C. I. Nos. 1241 and 1258, bloomed between 10 a. m. and 12 m. than of the short grain varieties. The maximum period of blooming of rice flowers in California appears to be later in the day than in other countries for which such data are available.

The soy bean: Its history, culture, and uses, F. BOTTARI (*La Soja: Nella Storia, Nell' Agricoltura e Nelle Applicazioni Alimentari ed Industriali*. Turin: S. Lattes & Co., 1923, pp. [5]+243, pl. 1, figs. 30).—This volume treats of the origin and history of soy beans, methods and extent of production in different countries, uses for food and feedstuffs, and industrial applications of the crop.

Environmental factors affecting the protein and the oil content of soybeans and the iodine number of soybean oil, R. W. STARK (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 10, pp. 636-645).—Investigation of the composition of soy beans grown in rotations variously fertilized on the Carthage, Raleigh, Sparta, and Odin soil fertility fields of the Illinois Experiment Station showed some correlation apparent between the yield of beans and their composition, an increase in yield frequently being coincident with an increase in protein content and a decrease in the oil.

Applications of limestone and organic matter were found to increase the percentage of protein and decrease the percentage of oil in a marked degree, and these tendencies were further pronounced by additional applications of rock phosphate. Potassium applied in addition to rock phosphate, limestone, and residues resulted in a decreased percentage of protein and an increase in that of oil. The acre yield of oil was increased by applications of organic matter, and limestone in addition to organic matter caused a large increase in oil production, while phosphorus and potassium apparently had little effect upon the acre yield of oil.

Analyses of four varieties of soy beans from different sections of Illinois, considered with the data from the plats, showed that such variations as were observed in this investigation were apparently not due to geographical position or climatic condition, but may probably be attributed chiefly to differences in soil fertility and soil reaction. Greater differences in composition may be found within the variety than exists normally between different varieties. From the evidence in these experiments soy beans seem to tend toward a uniform protein content when the conditions favor large protein production. A fairly close correlation is to be seen between the protein and the oil content of different lots of the same variety of soy beans. Conditions producing an increased percentage of protein result in a decreased oil content, and vice versa.

Wide differences were noted in the average iodine number characteristic of the different varieties. Within the varieties considerable variation was found, but it was not consistent enough to indicate that location or soil treatment was responsible.

Report on the sugar-cane experiments for the season between 1921-1923, J. R. BOVELL and J. P. D'ALBUQUERQUE (*Barbados Dept. Agr., Rpt. Sugar-Cane Expts., 1921-1923*, pp. 65).—The details of varietal and fertilizer trials with sugar cane in Barbados along the same general lines as recorded previously (E. S. R., 49, p. 133) are discussed and tabulated for the season indicated, together with rainfall data and comment on the prevalence of the root borer (*Diaprepes abbreviatus* L.) and the brown hardback (*Phytalus smithi* Arrow).

The relation of moisture and available nitrogen to the yield and protein content of wheat, R. E. NEIDIG and R. S. SNYDER (*Soil Sci.*, 18 (1924), No. 3, pp. 173-179).—To correlate definitely the effect of different percentages of moisture on the protein content and yield of wheat both with and without an excess of available nitrogen (E. S. R., 47, p. 636), Palouse Bluestem wheat was planted at the Idaho Experiment Station in pots on soil with different fixed and alternating moisture contents, and receiving sodium nitrate at planting or in cumulative additions.

The results of this work indicated that a high moisture content in soil with enough available nitrogen for the maximum growth and development of the wheat plant results in high yielding wheat with a high percentage of protein. A low moisture content in soil containing excessive available nitrogen results in a lower wheat yield but a higher protein content. A high or optimum moisture content in a soil having considerable nitrogen available for the plant in the early periods of growth, but not enough during the fruiting and ripening periods for maximum growth, results in a high yield of wheat with a low protein content. A low moisture content in a soil having enough nitrogen available to the plant during the early growth stages, but not enough for the fruiting and ripening periods, results in a low yield of wheat, the percentage of protein varying according to the degree to which the wheat is shriveled from moisture deficiency. An example of the effect of moisture on the yield and protein content of wheat grown under field conditions is shown by a comparison of several years' data from a rotation experiment in progress at the station.

Varietal experiments with hard red winter wheats in the dry areas of the western United States, J. A. CLARK and J. H. MARTIN (*U. S. Dept. Agr. Bul.* 1276 (1925), pp. 48, figs. 3).—Yields and other important agronomic data are presented in detail and summarized for about 110 varieties and strains of winter wheat grown cooperatively in plats in Idaho, Kansas, Montana, North Dakota, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Milling and baking tests were made with samples of the more important varieties. The hard red winter wheats consistently outyielded the other classes of winter wheat.

Kharkof, the standard for comparison, was found to be equal or slightly superior to Turkey, the leading variety of hard red winter wheat, in yield, winter hardiness, and other agronomic characters, and in milling and baking quality. Several strains of these or other hard red winter wheats seemed to have certain advantages over Kharkof and Turkey, although most of the sorts tested were not superior to them. In general, Kanred was the most productive hard red winter wheat for the Great Plains area. Other high yielding wheats include Alberta Red, Argentine, Beloglina, Blackhull, Karmont, Montana No. 36, Nebraska No. 60, and Turkey (C. I. No. 1571). Few strains or varieties were found to be distinctly earlier and taller than Kharkof. Blackhull exceeds most of the other varieties in these characters, which appears to give it a decided advantage in some sections. In winter hardiness Minturki, and in stem rust resistance Kanred, have surpassed most of the other varieties of hard red winter wheat. As determined from the crude protein content, yield of straight flour, and volume of loaf, Beloglina, Kanred, and Minturki have distinct advantages over Kharkof and other hard red winter wheats for milling and baking.

Report of trials of Yeoman II wheat, 1922-23, W. H. PARKER (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 4-8).—Comparisons at 10 centers in England showed Yeoman II wheat, produced by R. H. Biffen, practically to equal Selected Yeoman in yields.

Report on the quality of a new form of wheat, compared with Selected Yeoman and older forms of English wheat, A. E. HUMPHRIES and R. HUTCHINSON (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 9-18, pl. 1).—In milling and baking tests Yeoman II and Selected Yeoman wheat grown at the 10 centers mentioned above surpassed in baking quality ordinary English varieties grown in the same areas. Earlier baking tests showed Yeoman II to excel ordinary Yeoman in baking quality and to approximate closely the strength of Red Fife and No. 1 Northern Manitoba.

Report on the quality of Red Fife wheat grown successively in England for twenty-one years, A. E. HUMPHRIES and R. HUTCHINSON (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 3-16, pl. 1).—Milling and baking tests showed that Red Fife wheat after continuous production for 21 years in England retained its characteristics even when sown in 11 differing environments in Great Britain. Although it is said that flour from ordinary English wheat can not be subjected successfully to extended baking processes, the Red Fife behaved as well as No. 1 Northern Manitoba in this respect. Even when the wheat contained from 18 to 21 per cent of moisture after harvest, its quality was not substantially affected. Differences in gluten content did not seem to be correlated with the differences in loaf volume. Red Fife almost invariably yields insufficient gas in panary fermentation unless some form of yeast food is used.

Ten years' grain and seed testing in Montana, C. MCKEE and W. O. WHITCOMB (*Montana Sta. Bul.* 167 (1924), pp. 18, figs. 6).—The activities of the Montana Grain Inspection Laboratory during the period 1913-1922 are reviewed, with comment on its work during the year ended June 30, 1923. Tabulations show the average germination and purity of 2,783 samples of field crops seed, 1,167 of vegetable seed, and 851 samples of flower seed received; the hard seeds in legumes; the percentages of 1,710 wheat samples graded into the several classes and grades and the reasons for low grades; the test weights and dockage content of the several wheat grades; and the composition of mixed wheat as graded. Montana seed tests are compared with those from other laboratories.

Agricultural seed inspection, A. S. LUTMAN (*Vermont Sta. Bul.* 241 (1924), pp. 3-7).—Tabulations show the purity, guaranty, percentage of germination, and number of weed seed per pound for 91 samples of agricultural seed taken from local dealers in the State during April and May, 1924.

Seed testing investigations and miscellaneous work (*Ireland Dept. Agr. and Tech. Instr., Ann. Gen. Rpt.*, 22 (1921-22), pp. 48-50).—About 50, 33, and 25 per cent, respectively, of the hard seeds of red clover, white clover, and alsike clover germinated during the first 2 years with the usual laboratory methods. During the succeeding years germination continued at a very low rate, not ceasing even at the end of the tenth year. With all three clovers the total germination was greater in soil than in the germinators. The addition of basic slag to the soil had no effect in hastening the germination of hard seeds.

At the end of 10 days the germination of cereals at a constant temperature was found to be practically the same as that at alternating temperature. Mangel seed seemed to germinate rather poorer when tested in soil than in sterilized silver sand, the usual laboratory method. Where sand is used the germination is practically complete at the end of 2 weeks, the normal time for the test. In tests of samples of inferior perennial rye grass and Italian rye grass, the best results were obtained at 20° C. (68° F.), and 14 days sufficed for the completion of the test.

Results in longevity studies showed that although the total period in which some of the seeds in each case remain viable did not differ widely for high

and low initial germinations, yet the loss of vitality was generally more rapid when the initial germination was low.

Official Seed Testing Station for England and Wales—sixth annual report, [1923], C. B. SAUNDERS (*Jour. Natl. Inst. Agr. Bot.*, No. 2 (1924), pp. 20–28, fig. 1).—The average purity and germination are tabulated for 21,678 samples of agricultural seed received during the year ended July 31, 1923.

Morphological differences of the seeds of some species of Carophyllaceae [found in Russian clover seed] [trans. title], K. V. KAMENSKIĖ (*Zap. Semenovedeniia* (Ann. Essais Semences, Jardin Bot. Petrograd), 4 (1923), No. 5, pp. 3–13).—*Silene dichotoma*, *S. inflata*, and *Lychnis* (*Melandrium*) *alba* are the species of Carophyllaceae seen most frequently in samples of clover seed in Russia, while *S. noctiflora* appears rather seldom. *S. inflata* is seen oftenest in clover from southern and middle Russia as well as from the northern section of European Russia. While *L. alba* is found almost everywhere, it is seldom seen in clover from the northern governments. *S. dichotoma* is found principally in clover from the southern governments, for which it may be considered as indicative. *S. noctiflora* appears infrequently in clover from southern Russia. Agronomic data and characteristic differences of these seeds are given in a German résumé.

The jointed cactus, S. SCHONLAND (*Union So. Africa Dept. Agr. Jour.*, 9 (1924), No. 3, pp. 216–225, figs. 3).—The distribution in the Cape Province, adaptation, and dissemination of the jointed cactus (*Opuntia aurantiaca*), a weed pest menacing certain areas in the Cape Province of South Africa, are discussed with comment on eradication methods.

Cuscuta in Iowa, G. L. WITROCK (*Iowa Acad. Sci. Proc.*, 30 (1923), pp. 351–354, fig. 1).—This account of the occurrence and distribution of *Cuscuta* (dodder) in Iowa discloses the presence of 11 species in the State.

HORTICULTURE

[**Horticultural investigations at the Canadian experimental stations and farms**] (*Canada Expt. Farms, Rpts. Supts. 1923, Agassiz* (B. C.) *Farm*, pp. 19–27; *Cap Rouge* (Que.) *Sta.*, pp. 16–32, 33, 34, fig. 1; *Charlottetown* (P. E. I.) *Sta.*, pp. 16–20, 20–22; *Fredericton* (N. B.) *Sta.*, pp. 28–37; *Invermere* (B. C.) *Sta.*, pp. 7, 10–12; *Kapuskasing* (Ont.) *Sta.*, pp. 31–40; *Lennoxville* (Que.) *Sta.*, pp. 23–33, figs. 3; *Lethbridge* (Alta.) *Sta.*, pp. 28, 29, 30, 31; *Morden* (Man.) *Sta.*, pp. 15–25, 27–31, figs. 2; *Nappan* (N. S.) *Sta.*, pp. 23–27, 28, 30, 31; *Scott* (Sask.) *Sta.*, pp. 28–34, 36–40, figs. 4; *Sidney* (B. C.) *Sta.*, pp. 9–20, 21–29, figs. 2; *Ste. Anne de la Pocatière* (Que.) *Sta.*, pp. 16–21; *Indian Head* (Sask.) *Farm Rpts. Supt. 1921–1922*, pp. 20–24, 26–30; 1923, pp. 19–23; *La Ferme* (Que.) *Sta. Rpt. Supt. 1922–1923*, pp. 46–53).—In each of the above pamphlets there is included a report upon horticultural activities by W. H. Hicks, G. A. Langelier, J. A. Clark, C. F. Bailey, R. G. Newton, S. Ballantyne, J. A. McClary, W. H. Fairfield, W. R. Leslie, W. W. Baird, M. J. Tinline, E. M. Straight, J. A. Ste. Marie, N. D. MacKenzie, and P. Fortier, respectively, which for the most part consisted of cultural and varietal tests of fruits, vegetables, and ornamental plants.

Attempts at the Sidney Station to stimulate sweet pea germination by immersing seed for 20 minutes in concentrated sulfuric acid yielded negative results, the acid treated seed germinating less than the untreated.

Memorial of the hundredth anniversary of the founding of the Dahlem Experimental Station (*Denkschrift zum 100 Jährigen Bestehen der Höheren Gemüsebaues. Berlin: Paul Parey, 1924*, pp. XIX+1065, figs. 263).—This com-Trowitzsch & Son, 1924, pp. 240, pls. 2, figs. 62).—This is a record of the his-

tory, personnel, activities and achievements, and present equipment of this institution, located near Berlin.

Red as a protective color in vegetation, R. B. HARVEY (*Jour. Forestry*, 23 (1925), No. 2, pp. 179, 180).—A brief article in which the author points out that the red color found in the fruiting and vegetative parts of plants has a distinct protective value, such portions tending to become less heated in direct sunlight than green, brown, gray, or black surfaces.

Handbook of vegetable gardening, J. BECKER (*Handbuch des Gesamten Gemüsebaues*. Berlin: Paul Parey, 1924, pp. XIX+1065, figs. 263).—This comprehensive manual is practically a monograph on vegetable growing, containing as it does information on general culture, forcing, storage, seed production, vegetable breeding, and technical descriptions of nearly all cultivated aromatic, medicinal, and kitchen garden plants, arranged according to their botanical relationships. In addition considerable data on the chemical composition of vegetables are included.

Field notes on carrots, L. L. MORSE (*San Francisco: C. C. Morse & Co.*, 1924, 2. ed., rev. [and enl.], pp. 24, figs. 16).—Beginning with comments on the carrot seed-producing industry in California, the author presents brief technical descriptions of the principal carrot varieties of the United States.

Premature seeding of celery, C. C. STARRING (*Montana Sta. Bul.* 168 (1924), pp. 16, fig. 1).—A presentation of material the greater part of which has been noted from another source (E. S. R., 51, p. 143).

A new method for blanching celery, R. B. HARVEY (*Minn. Hort.*, 53 (1925), No. 2, pp. 41-43, figs. 2).—Preliminary observations upon the use of ethylene gas as a medium for blanching celery indicated that a very satisfactory product may be obtained with six days' exposure, thus materially reducing the usual time required to blanch celery without in any way reducing the quality.

Greenhouse tomatoes, J. H. BEATTIE (*U. S. Dept. Agr., Farmers' Bul.* 1431 (1924), pp. II+25, figs. 7).—In addition to presenting general information on various phases of glasshouse tomato production, data are included on the comparative yields of English and American tomato varieties in the Arlington Experiment Farm glasshouses. In general, the large fruited American types were more productive than the English sorts.

Fruit statistics of Canada, 1920-23 (*Canada Bur. Statis., Fruit Statis.*, 1920-1923, pp. 20).—This brief statement comprises statistical data on production and prices of the various tree and small fruits grown in Canada.

Orchard management, J. H. GOURLEY (*New York and London: Harper & Bros.*, 1925, pp. VIII+247, pls. 7, figs. 13).—A comprehensive discussion of the various phases of fruit production.

Top-working fruit and nut trees by the Biederman bark graft method, A. F. KINNISON (*Ariz. Agr. Col. Ext. Circ.* 49 (1924), pp. 23, figs. 16).—This contains practical information.

Cranberry picking studies, H. J. FRANKLIN (*Cape Cod Cranberry Growers' Assoc. Ann. Apt.*, 36 (1923-24), p. 8).—Investigations conducted at the State Experimental Bog, East Wareham, Mass., in the fall of 1922 showed that the method of harvesting in which cranberries are scooped from a flooded bog greatly impairs the keeping quality of the fruit. Fruits gathered in the late afternoon kept better, other things being equal, than those gathered in the heat of midday.

Some results of recent experiments in pruning raspberries, S. JOHNSTON (*Mich. State Hort. Soc. Ann. Rpt.*, 53 (1923), pp. 12-15).—Studies conducted at the South Haven, Mich., substation on red and black raspberries indicated the importance of paying increased attention to the number and vigor of canes left after pruning and the number of buds carried on such canes.

In the case of the black raspberry the best results, where size of the berry as well as total yield was considered, were obtained with plants pruned to four canes, with laterals cut back to an average length of four buds. A definite correlation was observed between cane diameter and yields, the largest canes being associated with the largest yields and the largest-sized berries.

In the case of red raspberries, where the canes were pruned back to various heights the yield increased with the height of the cane. However, it was noticed that the size of the berries decreased rapidly above the thirty-fifth bud, and that the long canes bend too easily with the load of ripening fruits. The diameter of the canes was found to be equally as important an index to value in the red as in the black raspberry.

Manual of American grape-growing, U. P. HEDRICK (*New York: Macmillan Co., 1924, rev. ed., pp. XIII+458, pls. 32, figs. 54*).—In presenting this new and revised edition (E. S. R., 41, p. 446), the author states that material changes have been made in those sections relating to grape products and to grape varieties, some varieties being discarded in favor of more recent introductions.

Results of two years' work in pruning and training Illinois grapes, A. C. VOGELE (*Ill. State Hort. Soc. Trans., 58 (1924), pp. 123-127*).—A study of the relation of the number of buds left subsequent to pruning to the yield of fruit showed, in general, that the larger number of buds up to the maximum observed in the study (from 56 to 65) was correlated with increased production. In the instance of low-producing vines, the number of buds left per vine was, apparently, of less significance than in the case of high producers. The most fruitful type of cane was that which at the third node was approximately from 10 to 15 times as long as the diameter of the cane. Canes less than 0.65 cm. in diameter were invariably poor producers and weakly vegetative. Canes of 0.65 to 0.85 cm. in diameter were the most fruitful, while those from 0.85 to 1.00 cm. inclined to be less fruitful, and large, thick canes whose diameters exceeded 1.00 cm. were invariably poor producers, possessing long internodes, fewer leaves, and low carbohydrate supply. It was found that the small bud close to the base of each cane was invariably dormant or produced a fruitless cane. In fact, only a few clusters of fruit were produced from this basal bud in observations on approximately 950 canes.

An investigation into some physical and chemical changes occurring in grapes during ripening, P. R. v. D. R. COPEMAN (*Union So. Africa Dept. Agr. Sci. Bul. 30 (1924), pp. 38, figs. 29*).—Working at the Government Wine Farm, Groot Constantia, South Africa, with four varieties of grapes, an attempt was made to establish simple physical and chemical standards by which grapes may be judged suitable for picking for export. The author found that, if the changes in the weight of berries were taken into consideration, the total yield of sugar from a given number of berries reached a limiting value at a stage when the grapes could be considered ripe. Density and degrees Balling of the juice showed irregular increases. Sucrose content increased steadily throughout the entire period. Acidity showed a gradual continuous decrease during the entire storage period, but was not in direct inverse proportion to the increase in glucose. A tendency was observed for the proportion of acid to glucose to arrive at a limiting value of 0.2. The H-ion concentration of the juice increased gradually.

Problems of the viticultural industry, A. V. LYON (*Aust. Inst. Sci. and Indus. Bul. 28 (1924), pp. 84, figs. 17*).—A discussion of grape growing in the irrigated lands of the Murray Valley, Victoria, laying stress on pruning, training, irrigation, fertilization, and control of fungus and insect enemies.

The California raisin industry: A study in geographic interpretation, C. C. COLBY (*Ann. Assoc. Amer. Geogr., 14 (1924), No. 2, pp. 49-108, figs. 13*).—

Conditions favoring the growing of raisin grapes are found to exist nearly to perfection in the middle section of the San Joaquin Valley, where low humidity and rainfall are combined with an abundant supply of pure irrigation water, drawn from rivers rising in the upper reaches of the Sierra Nevada Mountains and so located that water may be distributed largely by gravity flow. The weather in September and October is usually characterized by clear, bright days and low humidity, conditions favoring the production of high-grade raisins. As a result of the favorable environment, the production of satisfactory crops has been regular and has contributed to the building of a permanent and stable industry, reflected in comfortable homes and in a vigorous, intelligent population.

The author discusses in a general way the early history of grape growing in California, pointing out the many obstacles, such as unfavorable irrigation laws, improper marketing practices, insect and fungus pests, etc., which have been overcome. Success in marketing came with the organization in 1913 of a cooperative association, which, through the introduction of improved drying and packing practices and the stimulation of consumption through nationwide advertising, has been the vital factor in keeping the raisin industry in a prosperous condition despite economic readjustments in the postwar period and a greatly increased production.

Smyrna fig culture, C. G. SAVAGE (*Jour. Dept. Agr. So. Aust.*, 28 (1924), No. 5, pp. 404-421, figs. 8).—A general article, paying particular attention to the subject of pollination through the agency of the *Blastophaga* insect.

Fertilizer studies with the olive [trans. title], J. BONNET (*Prog. Agr. et Vitic. (Éd. l'Est-Centre)*, 45 (1924), No. 49, pp. 544-546).—In tests conducted at La Fare and Ledenon, France, complete fertilizer plats returned yields per tree of 19.4 and 29.8 lbs., respectively, increases of 14.7 and 15.3 lbs. above the average of the control trees.

Report of an investigation of coffee, S. C. PRESCOTT (*New York: Joint Coffee Trade Publicity Com.*, 1924, pp. 84, figs. 5).—Herein are reported the results of a comprehensive study of coffee, considering such points as chemical and physiological properties, roasting of coffee, preparation of beverage coffee, etc.

Pecan growing, H. P. STUCKEY and E. J. KYLE (*New York: Macmillan Co.*, 1925, pp. XIII+233, pls. 12, figs. 33).—A comprehensive discussion of pecan production, taking into consideration the history and development of the industry, propagation, general culture, harvesting and marketing, control of insect and fungus pests, botany, varieties, etc.

The pecan in Texas, J. H. BURKETT (*Texas Dept. Agr. Bul.* 77 (1924), pp. 177, pls. 20, figs. 71).—A revision of a previously noted bulletin (E. S. R., 48, p. 738).

Rhododendrons for amateurs, E. H. M. COX (*London: Country Life, Ltd.*; *New York: Charles Scribner's Sons*, 1924, pp. XVI+112, pls. 15, fig. 1).—Information of a popular nature is presented on the culture of the rhododendron, paying special attention to the selection of desirable species and varieties.

Shrubs for amateurs, W. J. BEAN (*London: Country Life, Ltd.*; *New York: Charles Scribner's Sons*, 1924, pp. VIII+117, pls. 15).—A small handbook devoted to the cultivation, transplanting, arrangement, pruning, propagation, selection, and characteristics of various plant materials.

The week-end gardener, F. H. FARTHING (*London: Grant Richards, Ltd.*, 1924, [3. ed.], pp. 455, pls. 16, figs. 380).—A guide for the amateur gardener, with material arranged according to the activities of the various months.

The little garden for little money, K. L. BREWSTER (*Boston: Atlantic Monthly Press*, 1924, pp. [9]+109, pls. 8, figs. 4).—A popular account dealing

chiefly with the choice of proper plant material for various situations about the home.

Planning and planting for the home beautiful, C. B. FARGO (*New York: Author, 1925, pp. 222, pls. 3*).—Information of a general nature relative to desirable varieties and species of ornamental plants and the care is presented.

FORESTRY

Some ecological effects of shading coniferous nursery stock, C. F. KORSTIAN (*Ecology, 6 (1925), No. 1, pp. 48-51, fig. 1*).—Studies carried on at the Cottonwood Nursery, Utah, by the U. S. D. A. Forest Service showed that the degree of insolation received by young conifers has a direct effect upon the structure of the leaves and, incidentally, on the physiological activities of the entire plant. Analysis of the leaf sap of shaded and openly exposed 3-year-old Douglas fir seedlings showed that shading has a decided effect in lowering the sap density. The leaves of the shaded plants had a less compact structure, thinner epidermis and cuticle, more spongy tissue, closer lying cells, and less deeply depressed stomata than those of the fully insolated plants.

In respect to the optimum amount of shade, Englemann spruce and Douglas fir thrived best under half shade, while lodgepole pine and western yellow pine were grown successfully without any shade. The beneficial effects of shading are deemed to lie in the reduction of soil evaporation and plant transpiration, increased humidity, and lower temperature. Too much shade, however, was found to prolong growth into late autumn and to cause seedlings to become weak and slender and undesirable for transplanting. As a practical deduction, it is recommended that seedlings destined for planting in the open be exposed to full sunlight during their last year in the nursery and, reciprocally, that stock for shaded sites be shaded in the nursery.

The Rainbow forest plantations: Guide to experimental plots and report of progress, 1924, H. W. HICOCK (*Connecticut State Sta. Bul. 262 (1924), pp. 103-135, pls. 9*).—Of a large number of forest species and combinations of species tested on a comparatively infertile, sandy soil located in the towns of Windsor and East Granby, three species, namely, the red, white, and Scotch pines, were found by far the most satisfactory. The hardwoods, in no measure as satisfactory as conifers, contained only three promising species, red oak, black locust, and chestnut, all of which suffered to such an extent from animal, insect, and fungus pests as to be considered almost complete failures. The red and the white pines were found to make about equal growth, but, since the white pine is very subject to injury from the weevil, the red is deemed the better of the two species. Scotch pine made a rapid growth but was somewhat inclined to develop crooked boles, and hence final judgment on the species is withheld until the trees have reached a marketable age. Seeding proved unsatisfactory; in fact, regeneration by this practice was abandoned early in favor of planting stock. A map of the area is included.

Forest planting in the intermountain region, C. F. KORSTIAN and F. S. BAKER (*U. S. Dept. Agr. Bul. 1264 (1925), pp. 57, pls. 7, figs. 7*).—Based on experience gained in reforestation operations, the authors discuss the various phases of the problem of planting in a region characterized by limited rainfall and great temperature fluctuations. Under such conditions direct seeding proved a failure. Among the various points considered in the paper are the collecting and handling of seed, nursery practices, choice of field sites for the various species considered, best age of planting stock, rates and time of planting, planting practices, survival expectancies, various factors concerned in limiting survival, costs of planting, the general outlook for planting on the area discussed in the bulletin, etc.

The growth, returns, and uses of planted cottonwood in Iowa, G. B. MACDONALD (*Iowa Sta. Bul.* 223 (1924), pp. 167-201, figs. 13).—Because of its extremely rapid growth and ability to thrive on soils subject to overflow and, therefore, unfit for general agricultural purposes, the cottonwood (*Populus deltoides*) has become increasingly valuable in Iowa.

That diameter increment is extremely rapid under favorable growing conditions was shown in measurements taken in a 12-year-old plantation established on the station grounds. The trees averaged 6.66 in. in diameter, equivalent to an average annual increment of 0.55 in. Trees planted in single rows made much more rapid diameter gain than did those of the same age in plantations. Height records taken in several plantations showed remarkably rapid development, especially in young trees located on fertile bottom lands. As with other trees, a moderate amount of crowding was apparently necessary for the development of tall, straight stems.

Records taken in various parts of the State showed that, with reasonable care and protection, cottonwood plantations are capable of producing in 35 years a yield of 30,000 bd. ft. per acre in addition to considerable fuel material. Cottonwood has also proved of great value to Iowa farmers in the production of posts which, when properly creosoted, last many years. The lumber, valuable in the construction of barns, sheds, and other rough buildings, is capable of long endurance when properly protected from the weather.

Aspen in the central Rocky Mountain region, F. S. BAKER (*U. S. Dept. Agr. Bul.* 1291 (1925), pp. 47, pls. 10, figs. 3).—A comprehensive discussion, taking into consideration the distribution of the species, botany of the tree, variability in response to environments, climatic requirements, soil and moisture needs, tolerance to adverse light conditions, susceptibility to disease, insect and other animal pests, reproduction, species associations, rate of growth, yield on different quality sites, properties and uses of the wood, systems of silvicultural management, etc. Volume tables are appended.

The growing season of western yellow pine, G. A. PEARSON (*Jour. Agr. Research* [U. S.], 29 (1924), No. 4, pp. 203, 204, figs. 2).—Dendograph records taken in 1923 at the Southwestern Forest Experiment Station, Flagstaff, Ariz., upon two western yellow pine trees, 5.4 and 15.8 in. in diameter, showed approximate accretion periods of 117 days for the smaller tree and 88 days for the larger tree. Growth in the smaller tree embraced the period May 16 to September 10 and in the larger tree June 1 to August 27. The maximum development for the smaller tree occurred during the first days of June. In both trees diameter enlargement continued longer than shoot development, which on the basis of 14 years' observations was found to practically cease in the western yellow pine by July 1.

The caoutchouc in Indo-China [trans. title], L. CARTON (*Bul. Écon. Indochine, n. ser.*, 27 (1924), No. 167, pp. 349-456, pls. 4, figs. 21).—A general discussion relating to the early history of rubber production in Indo-China, the rubber-supplying species, introduction of *Hevea brasiliensis*, methods of culture of *Hevea*, collection and manufacture of latex, the improvement of *Hevea* by tree selection, etc.

Report on the forest administration of the Central Provinces for the year 1922-23, H. A. FARRINGTON (*Cent. Provs. [India] Forest Admin. Rpt.*, 1922-23, pt. 1, pp. [7]+34; [pt. 2], pp. LXI).—Like that of the preceding year (*E. S. R.*, 51, p. 146), this report is presented in two pamphlets, the first of which deals with general information concerning forest policies, alterations in area, construction activities, forest protection, silvicultural practices, exploitation, etc., and the second contains tabulated statistical data.

DISEASES OF PLANTS

Report of the International Conference of Phytopathology and Economic Entomology, Holland, 1923, edited by T. A. C. SCHOEVEERS (*Wageningen: H. Veenman & Sons, [1923], pp. 290+IV, pls. 18, figs. 11*).—A brief general account of this conference has been noted (*E. S. R.*, 49, p. 398). The papers and other data presented included the following:

General Remarks on Potato Diseases of the Curl Type, by H. M. Quanjer (pp. 23-28); Some Peculiar Pathological Conditions in the Leaves of Potatoes Affected with Mosaic Disease, by K. M. Smith (p. 30); Oospores of *Phytophthora infestans*, by H. L. G. de Bruyn (pp. 30, 31); Verticillium Wilt, by J. H. H. van der Meer (pp. 31, 32); Stipple Streak Disease of Potato (p. 32), and The Fusarium Disease of Cereals, both by D. Atanasoff (pp. 32, 33); Resistance of Several Strains of White Flowering Flax to *Melampsora lini*, by J. C. Dorst (p. 33); The Mycoplasma Stage of *P. infestans* [trans. title], by J. Eriksson (pp. 33, 34); Premature Tuber Formation in Early Potato Varieties, by S. J. Wellensiek (pp. 34, 35); Insect Transmission of "Curl" Diseases of Potato, by D. L. Elze (p. 35); International Cooperation in Combating Plant Diseases and Insect Pests, by L. O. Howard (pp. 36-38); Potato Leaf Roll Influenced by the Origin of the Tubers, by E. Gram (pp. 38, 39); The Visibility of Symptoms of Potato Mosaic [trans. title], by V. Ducomet (pp. 39-43); The Valuation of Seed Potatoes from the Standpoint of Plant Protection [trans. title], by G. Köck (pp. 43-48); The Proposed Separation of Phytopathology into Practical Botany and Practical Zoo-(Entomo-)logy [trans. title], by L. Reh (pp. 48-51); How Do We Receive and Keep Phytopathological Information? by E. Gram (pp. 51-53); International Phytopathology, by C. L. Shear (pp. 53-58); "Internal Rust Spot" Disease of the Potato Tuber, by S. G. Paine (pp. 74-78); The Supposed Relation of Potato Skin Spot to Corky Scab, by W. A. Millard and S. Burr (pp. 78, 79); Anatomical and Microchemical Alterations in Potato Phloem [trans. title], by Von Brehmer (pp. 79-85); Organization and Methods of the Phytopathological Service of Holland, by N. van Poeteren (pp. 86-96); International Plant Disease Legislation as Viewed by a Scientific Officer of an Importing Country, by H. T. Güssow (pp. 96-107); Remarks on Plant Disease Legislation in Canada, by A. Gibson (pp. 107-110); Mistakes and Misuse in Connection with Protective Media [trans. title], by J. Bernátsky (pp. 126-131); Proposals for an Acceptable Evaluation of Plant Protective Media [trans. title], by E. Riehm (pp. 131-135); Diseases of Crops on Alkaline and Sour Soils, by J. Hudig (pp. 136-141); The Potato-selection Farm at Oostwold, by J. O. Botjes (pp. 142-147); Transmission of Leaf Roll of Potatoes in N. Wales During 1921, by I. Whitehead (pp. 147-149); Modern Methods of Combating Bulb Diseases, by E. van Slogteren (pp. 150-162); The Central Bureau for Fungus Cultures (pp. 165-171) and Studies on *Nectria coccinea* and *N. galligena* [trans. title] (pp. 171-173), both by J. Westerdijk; On the Resistance of the Potato Tuber Against Phytophthora, by M. P. Löhnis (pp. 174-179); The Biology of *Vermicularia varians* [trans. title], by D. Cavadas (pp. 181-183); Some Facts Regarding the Erysiphaceae [trans. title], by E. Foex (pp. 184-190); Protozoa in Plants [trans. title], by J. Franchini (pp. 191-195); A New Fungus Enemy of Dwellings, *Phellinus cryptarum* [trans. title], by L. Mangin (pp. 196-199); On the Development of Wheat Rusts in Relation to Climatic Conditions, by J. Beauverie (pp. 201-203); Root Rot of Peas in the United States (pp. 203, 204), and Mycorrhizal Fungi in the Roots of Legumes (pp. 204, 205), both by F. R. Jones; European Phytopathologic Collaboration, by J. Eriksson (pp. 205-214); Plant Protection and Instruction [trans. title], by O. Appel (pp.

226-231); The Effects of Partial Sterilization of the Soil, by E. J. Russell (pp. 233-238); Historical Résumé of the Development of Phytopathology in Russia [trans. title] (pp. 238-243), and The Classification of Pathological Phenomena in Plants [trans. title], both by A. de Jaczewski (pp. 244-251); Methods for the Estimation of Injury Due to Cryptogamic Parasites [trans. title], by A. Naoumov (pp. 251-257); The Estimation of Injury Caused by Parasitic Fungi to Forest Species [trans. title] (pp. 258-262), Annular Rot of Oak Produced by *Vuilleminia comedens* [trans. title] (pp. 263, 264), and *Hydnum septentrionale*, a Parasite of [Forest] Trees [trans. title], all by E. Vanine (pp. 264-267); The Recent Threatening Development of *Tilletia secalis* in Russia [trans. title], by A. de Jaczewski (pp. 267-272); Methods of Combating Cereal Rust by Means of High Temperatures [trans. title], by A. Schitikova (pp. 272-275); Experiments Employing Soda as a Fungicide Against Erysiphaceae [trans. title], by A. Patkaniane (pp. 275, 276); Influence of Meteorological Conditions on the Development of Cereal Rust [trans. title], by L. Roussakov (pp. 277-280); and Fungus Diseases of Hungarian Medicinal Plants [trans. title], by G. von Moesz (pp. 280-283).

Cooperative dusting and spraying experiments in 1921 (*Crop Protect. Digest*, 1 (1922), No. 2, pp. 30).—In addition to a general account by C. R. Orton (pp. 1-6), the following reports are presented.

Results on apples and peaches in Connecticut, W. E. Britton, M. P. Zappe, and E. M. Stoddard (pp. 7-13).—Descriptive and tabular details are presented of the work as regards materials, methods, and results in different orchards.

Dusting for the control of sucking insects in New York, P. J. Parrott (pp. 13-15).—Brief accounts are given of experiments on apple, currant, potato, and cabbage.

Report on disease control in Pennsylvania, R. C. Walton (pp. 15-21).—In all the tests where lime-sulfur spray was used in comparison with dust materials superior control of apple scab upon both fruit and foliage was given. The data upon apple rust are meager, though lime sulfur appears to be more effective here also. Lime sulfur surpassed dust for control of frog-eye upon apple foliage, especially in cases of heavy infection. Fruit spot was effectively controlled in only one orchard, where infection was relatively slight. As regards sooty blotch, little difference was observed between various materials used. In the tests with dust mixtures for the control of leaf scab, sulfur, lead arsenate, and lime (80-10-10) and sulfur, lead arsenate, and nicotine (90-10-2) were the most effective, and copper dust (Niagara Potato Dust) was least effective. Practically no differences were noted in the efficiency of sulfur and lead arsenate (90-10) and sulfur, dry lime sulfur, and lead arsenate (75-15-10). Soluble sulfur showed practically as good fungicidal properties as commercial lime sulfur, but is not recommended as a summer spray because of severe foliage burning. The dusting materials considerably reduced the diseases (and defoliation), but did not control them effectively.

Report on insect control in Pennsylvania, S. W. Frost (pp. 21-23).—Data are given for curculio, codling moth, red bug, aphid, and leaf roller, both early and late.

Results in disease control in West Virginia, N. J. Giddings and A. Berg (pp. 23-26).—The data, as given by orchards or counties, show nothing in favor of the sulfur-dry lime-sulfur-arsenate mixture. In several orchards the copper-lime mixture and the sulfur mixture containing copper caused some injury to the fruit and foliage, which may have been primarily due to the small lumps of copper occurring in the mixture.

Results of dusting and spraying in Ontario, W. A. Ross (pp. 26-28).—In all parts of Ontario where apple scab was bad, dust mixtures gave deficient con-

trol, though good results were obtained where scab infection was comparatively slight. The failure of dusting was undoubtedly due to the fact that dust mixtures did not afford protection over a sufficiently long period. The weak point with dust lies in the fact that it washes off too easily.

General recommendations for future work (pp. 29, 30).—In all experiments on dusting and spraying it is deemed of the greatest importance that the machines used give adequate pressure and dispersal of the materials. Sprayers giving a pressure of less than 200 lbs. are considered of little use. The present state of perfection of dusting machines is not found to be generally satisfactory.

The relation of cucurbit mosaic to wild catnip, J. H. MUNCIE (*Abs. in Iowa Acad. Sci. Proc.*, 29 (1922), p. 346).—"Preliminary experiments by the writer show that cucurbit mosaic can be transmitted to *Nepeta cataria* by the insertion of crushed mosaic leaf tissue of mosaic gourd into the stems of catnip. Typical mosaic symptoms appeared on the tips of the leaves of the catnip in about three weeks, and after six weeks practically every leaf showed the mosaic. Mosaic of catnip has not been observed in the field by the writer, but with the ease of obtaining infection and chances of insect inoculation, this perennial host may be a source of early infection to cucumbers in the field."

Effect of hardness of water on the fungicidal value of mercuric chloride solutions, J. C. GILMAN (*Abs. in Iowa Acad. Sci. Proc.*, 29 (1922), p. 347).—A comparison of the fungicidal value of mercuric chloride solutions made up in tap water with those made up in distilled water showed the tap water solutions to be much less effective in killing the sclerotia of *Rhizoctonia solani* on potato tubers.

The health of seed [trans. title], DOIJER (*Dept. Binnenland. Zaken en Landb. [Netherlands], Verslag. Landbouwk. Onderzoek. Rijkslandbouwproefsta.*, No. 28 (1923), pp. 148-158).—This is an account of seed infection percentages and accompanying germinability under varied conditions in case of several economic plants.

Studies of insect transmission and cross-inoculation of mosaic on the Solanaceae, Cucurbitaceae, and Leguminosae, O. H. ELMER (*Iowa Acad. Sci. Proc.*, 29 (1922), pp. 311, 312).—Recent experimentation, tending to show that mosaic disease is not so limited in its host range as it was formerly thought to be, is confirmed by this brief note. "These data are of interest, in addition to the fact that the disease was transmitted by the mealy bugs, in that the infection was from Cucurbitaceae to Leguminosae and gives added proof that mosaic can be transmitted to plants belonging to other families and orders."

Rust infection of leaves in Petri dishes, G. P. CLINTON and F. A. MCCORMICK (*Connecticut State Sta. Bul.* 260 (1924), pp. 475-501, pls. 2).—A description is given of a method adopted by the authors for studying infection of leaves by rusts. Leaves used in inoculation experiments were placed in Petri dishes, and for most hosts in the experiments they remained in a living condition long enough to permit the development of the fungi. The method is considered to be as successful as that in which living plants are used and has the advantage of greater simplicity and of occupying much less space.

Altogether 13 different genera of rusts were used as follows: *Caeoma*, *Coleosporium*, *Cronartium*, *Gymnoconia*, *Gymnosporangium*, *Kuehneola*, *Melampsora*, *Melampsporidium*, *Melampsoropsis*, *Phragmidium*, *Puccinia*, *Pucciniastrum*, and *Uromyces*. Successful inoculations produced one or more infections with all these genera except the first. Forty-five species were used, and successful inoculations were secured with all but 17. Most inoculations were made with the I and II stages, but no new relationships between supposedly distinct species were found. Several new hosts, however, were secured

through inoculations, and a few old hosts are reported for the first time as having been experimentally demonstrated.

Details of inoculations and infections are given.

Stripe rust (*Puccinia glumarum*) of cereals and grasses in the United States, H. B. HUMPHREY, C. W. HUNGERFORD, and A. G. JOHNSON (*Jour. Agr. Research* [U. S.], 29 (1924), No. 5, pp. 209-227, pl. 1, figs. 5).—An account is given of the occurrence of stripe rust in the United States. This rust was first recognized as occurring in the United States in 1915 (E. S. R., 33, p. 744). It is now known to occur from British Columbia to Mexico and eastward to 103° W. longitude, and it has been found in all of the Pacific and Intermountain States except Nevada and New Mexico. In addition to attacking wheat, barley, rye, spelt, and emmer, *P. glumarum* is known to occur in nature on 34 wild grasses common to the United States. An aecial host for *P. glumarum* has not yet been discovered.

Certain varieties of wheat are apparently more subject to glume and kernel infection than others, and all susceptible varieties show general leaf infection. On most hosts the fungus is confined to the leaves and culms. Where it occurs on the kernels and glumes of certain varieties of wheat there is much shrinkage, and apparently the viability of the grain is reduced. The severity and spread of stripe rust in any locality devoted to winter wheat is said to depend on the fall weather conditions favorable to seedling infection, successful hibernation of mycelium, and spring weather conditions favorable to germination of urediniospores. In the Pacific Coast States the fungus has been found capable of surviving the winter by means of living mycelium or viable urediniospores. Varietal resistance studies have shown that several varieties of wheat are highly resistant to stripe rust.

Infection of barley by *Ustilago nuda* through seed inoculation, W. H. TISDALE and V. F. TAPKE (*Jour. Agr. Research* [U. S.], 29 (1924), No. 6, pp. 263-284, pls. 9).—This paper gives an account of recent studies which indicate that previous investigators have been confused regarding the infection of barley by *U. nuda*, at least to a certain extent, and that the fungus infects the seedlings and causes severe injury when heavily infected.

The fact that surface disinfectants have been found to control loose smut in certain varieties of barleys led the authors to carry on experiments with different varieties of barley, in some of which the hulls were removed and others not, after which they were heavily inoculated with smut spores. One variety, Nakano Wase, remained resistant throughout all the experiments. Seedlings from dehulled-inoculated seed of practically all varieties were severely injured, and in many cases they failed to emerge, while seedlings from hulled-inoculated seed were not noticeably injured. A microscopic study of seedlings revealed infection of the coleoptile and first leaves of the plumule of barley seedlings by *U. nuda*. Both susceptible and resistant varieties were infected.

Root-rots of wheat, A. W. HENRY (*Minnesota Sta. Tech. Bul.* 22 (1924), pp. 3-71, pls. 12, figs. 2).—An investigation of root rots of wheat was made, not only to get a survey of the fungi which cause root rots but also to determine their pathogenicity through inoculation experiments. The studies in the greenhouse demonstrated that the important pathogenes of wheat roots belong to the genera *Fusarium* and *Helminthosporium*. Some species of these genera, however, were nonpathogenic or only feebly attacked the host plants. Strains of other fungi penetrated the roots or caused deformities of them, but it was not considered that they would be destructive in the field. Among the species of *Fusarium*, *F. graminearum* (*Gibberella saubinetii*) was the most virulent pathogene of those studied. Strains of *F. moniliforme* and two species belong-

ing to the *Elegans* section, though less destructive, were also decidedly parasitic on wheat roots. In addition to wheat, *F. moniliforme* was found to attack barley, rye, oats, and corn.

Of the fungi of black pointed seeds studied, *H. sativum* was the most common cause of black point as shown by inoculation studies. However, two other species of *Helminthosporium*, as well as *Stemphylium parasiticum*, were capable of causing black point. In general, *H. sativum* was found the most common and the most destructive of the species of *Helminthosporium*, although at least three others were isolated from wheat. One of these is described as *H. pedicellatum* n. sp.

Temperature and other relations of the different fungi are discussed at considerable length, and the effect of disinfecting soil on the development of root rot is described.

A bibliography of 89 references is given.

Botrytis rot of the Globe artichoke, G. K. K. LINK, G. B. RAMSEY, and A. A. BAILEY (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 2, pp. 85-92, pl. 1).—A description is given of *Botrytis* rot of artichokes, which is said to occur seriously in shipments of Globe artichoke buds from California. A study of the organism showed that it was apparently of the *B. cinerea* type and was identical with those obtained from other vegetables. The disease is said to be of little importance in the artichoke fields but occasions considerable loss in shipments. The temperature and moisture relations of the fungus have been studied, and it is found to have a wide temperature range, although moisture appeared to be the principal limiting factor for infection. Control measures include field sanitation and possibly protective spraying or dusting, and also careful handling to avoid wounds in harvesting and packing. Low humidity and temperatures of about 5° C. (41° F.) in transit are recommended.

Celery diseases in Florida, A. C. FOSTER and G. F. WEBER (*Florida Sta. Bul.* 173 (1924), pp. 21-77, figs. 34).—A description is given of various diseases to which celery is subject in Florida, together with suggestions for their control.

The influence of broken pericarp on the germination and yield of corn, M. T. MEYERS (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 8, pp. 540-550).—Laboratory experiments with seed corn of six strains from northern, southern, and central Ohio indicated that the disease readings on the germinator were no more discriminating than careful examination of the ears before testing. Seed corn is ordinarily exposed under handling to many sorts of disease spores, which lead to serious injury following the moist conditions on the germinator. This is greatly increased by broken seed coats.

Field experiments gave no significant increase for disease-free ears, selected on the basis of disease readings on the germinator from carefully selected seed corn, over the most diseased-appearing ears, or over ears taken from the lot without reference to diseased appearance on the germinator.

Under field conditions, reduced stands were obtained from seeds with broken seed coats, the stands being reduced by unfavorable conditions, in some cases as much as 30 per cent, and seedling vigor being decidedly lessened by the same conditions. An unbroken seed coat proved to be complete protection against infection with spores of the same kind.

The nodal infection of corn by *Diplodia zeae*, L. W. DURRELL (*Abs. in Iowa Acad. Sci. Proc.*, 29 (1922), pp. 346, 347).—Corn dry-rot (*D. zeae*) was very prevalent in Iowa during 1921, particularly in the central portion of the State. The disease originates in the material left in the field, spores of the organism being blown to the young corn plants and germinating under conditions of extreme moisture and high temperature. Infection may occur on the

roots, stems, or ears, though the most common points of attack are the nodes. There is no consistent evidence of a migration of the disease from the soil to the ears or higher parts of the plant. All observations and experiments emphasize the fact that *D. zeae* infects locally at any point where blown spores lodge, and that moisture and temperature are essential.

Malformations of cotton plants in Haiti: A new disease named smalling or stenosis, causing abnormal growth and sterility, O. F. COOK (*Jour. Heredity*, 14 (1923), No. 7, pp. 323-335, figs. 6).—A cotton plant disease apparently new to north-central Haiti, causing abnormal growth and sterility and designated locally as smalling or stenosis, is described. A similar distortion of cotton was previously reported by the author for points in China in 1920 (*E. S. R.*, 43, p. 446). The disease in Haiti has been observed to affect several varieties, the Haitian cotton, however, appearing at least mainly immune.

The two disorders (Chinese and Haitian) show very similar results in altering the appearance and behavior of the plants, and are considered as belonging undoubtedly to the group of so-called mosaic diseases, which in some cases are caused by leafhoppers. Symptoms differ greatly in degree and general effect with different plants.

The upland type of cotton in Haiti showed a more general distortion and buckling of the leaves, with less tendency to discoloration and rolling under of the leaf margins, which were the special symptoms with upland cotton in China. Other comparisons are made. The disease is not contagious but is, apparently, carried. No recovery is noted, the growth continuing in abnormal fashion.

Haitian cotton, at least relatively immune, is described as not related to the Sea Island type, but as probably descended from material brought from the East Indies during the period of the French occupation. It belongs to *Gossypium purpurascens*. The type is usually called Bourbon cotton, and is here briefly described.

Onion smut in Indiana, C. T. GREGORY (*Ind. Acad. Sci. Proc.*, 38 (1922), pp. 318-320).—A survey of the important onion-growing regions of Indiana in 1922 showed smut disease to occur abundantly in Lake County, around Munster, and in one locality near Rensselaer in Jasper County. The losses caused are of two types, due directly to the destruction of the plants or indirectly to the production of oversized onions which are often discarded, not being salable as sets. It has been proved that the formaldehyde drip method of treatment will control the onion smut where onions are sown at the rate of 5 to 7 lbs. per acre. In Lake County, however, where the seed is sown at the rate of 60 lbs. per acre, the control is never 100 per cent, but it has been sufficiently effective to secure its adoption by the majority of growers. It is believed that spring plowing loosens the soil so that the formaldehyde penetrates too deeply for proper or sufficient disinfection. Rainfall is important, probably diluting the disinfectant or preventing uniform penetration. The usual dilution employed is 1 pint of 40 per cent formaldehyde in 16 gal. of water, to be used at the rate of 200 gal. per acre. The treated onions had about 5 per cent of smut, the untreated parts showing about 50 per cent. Increases in yields of 100 bu. per acre were obtained. At Munster dilutions as low as 1 pint in 10, 12, or even 14 gal. of water gave control of the smut in 1922, without causing seedling injury.

Bacterial pustule of soybean, F. A. WOLF (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 2, pp. 57-68, pls. 3, figs. 4).—A description is given of bacterial pustule of soy beans, together with accounts of the relation of this disease to

other soy bean leaf spots of bacterial origin, studies on the etiology of the disease, and on the morphology and physiology of the causal organism.

This disease, which is prevalent in North Carolina and also known to occur in Texas, Louisiana, South Carolina, Virginia, and Kansas, is said to be quite distinct from bacterial blight and from bacterial diseases of the soy bean which have been described from the Orient. The disease is apparently confined to the foliage and is caused by the organism described by Hedges as *Bacterium phaseoli sojense* (E. S. R., 48, p. 48). The author of the present paper reports his inability to find any morphological or physiological characters by which this organism can be differentiated from *B. phaseoli*.

A study of bacterial pustule of soybean, and a comparison of Bact. phaseoli sojense Hedges with Bact. phaseoli EFS., F. HEDGES (*Jour. Agr. Research* [U. S.], 29 (1924), No. 5, pp. 229-251, pls. 7).—In a previous publication the author gave a brief account of a pustule disease of soy bean, and attention was called to the similarity of the causal organism *B. phaseoli sojense* with *B. phaseoli*, the cause of bean blight (E. S. R., 48, p. 48).

In the present paper an account is given of further studies as to the identity of the two organisms, and their morphological and physiological characters are contrasted. They are said to differ in some of their cultural characters as well as to reactions when used to inoculate soy beans and species of *Phaseolus*. The organism from soy beans is said not to produce pustules on *Phaseolus*. *B. phaseoli* is only weakly pathogenic to soy beans, and in none of the experiments does it form pustules such as are characteristic of the soy bean disease.

Apple storage investigations, H. H. PLAGGE and T. J. MANEY (*Iowa Sta. Bul.* 222 (1924), pp. 64, figs. 16).—In continuation of investigations on apple storage (E. S. R., 43, p. 38) the authors give accounts of studies on the development and control of Jonathan spot, soft scald, apple scald, and internal breakdown in storage as influenced by orchard and storage conditions.

I. Jonathan spot and soft scald (pp. 2, 5-36).—Storage temperatures were found to influence the development of Jonathan spot, the proportion of spotting increasing with temperatures above 32° F. It also increased with relative humidity. Variation in size of fruit was found to have little effect on the development of spotting, and varying soil treatments did not control it. No relation was found to exist between temperature, rainfall, and sunshine during the growing period and the occurrence of Jonathan spot in storage.

The time of placing in storage, in relation to picking, and the kind of storage were found to be important factors. Immediate placing of fruit in cold storage is said to be better than delayed cold storage or ordinary storage. A constant air movement or wrapping fruit in oiled papers did not control Jonathan spot. This type of spotting is said to have been more severe during the latter part of the cold storage season and increased according to the time the fruit had been in storage. It is stated that Jonathan apples should not be held in storage longer than the first of January.

With reference to soft scald of Jonathan apples, maturity of the fruit when placed in storage and time of storing were found to be important factors. Delaying storage after picking or storing immature fruit resulted in increased scalding. Aeration and ventilation together reduced scalding, but aeration alone did not. Oiled wrappers did not control scald. Internal breakdown was not found to be a factor in the storage of Iowa Jonathan apples.

II. Apple scald and internal breakdown (pp. 37-64).—The authors have given an account of the amount of scald developing on Grimes apples grown under each of the four types of soil culture practiced at the station orchard at Council Bluffs, Iowa. No wide differences in the amount of scald were observed that could be attributed to soil treatment, although there was a slight

decrease in scald on apples from the blue grass plats, and this was attributed to the earlier maturity of the fruit. In the experiments maturity was found to be an important factor in scald development, Grimes apples picked in an immature condition having scalded badly. Delayed storage decreased the amount of scald on mature fruit, but the decrease was not always in proportion to the amount of delay. Aeration did not control apple scald. Oiled wrappers were found more effective as a scald preventive than aeration, and apples in an immature condition responded best to this treatment. Apples were said to have scalded worse when placed in wax or tin-foil wraps than in common paper wraps or unwrapped. Artificial scald, produced by ethyl acetate and acetaldehyde, was delayed or entirely prevented by wrapping apples in oiled wraps.

Experiments with Grimes apples are said to have shown that the occurrence of breakdown increased with late picking, as well as with delayed storing. Late picking with immediate storage was found comparable to early picking with late storage in the amount of breakdown. Wrapping fruit in oiled wraps and aerating the storage room were not effective in reducing internal breakdown, and differences in the rate of cooling between unwrapped, oiled paper wrapped, and common paper wrapped apples were slight and probably of no commercial significance. The effect of wrapping on temperature of apples was investigated and differences noted.

Freezing injury of apples, H. C. DIEHL and R. C. WRIGHT (*Jour. Agr. Research* [U. S.], 29 (1924), No. 3, pp. 99-127, pls. 5, figs. 12).—The investigations reported deal with determinations of the freezing points of many of the important commercially grown varieties of apples, with a study of undercooling and its relation to injury, and a determination of the effect of freezing on the bruising of the fruit, visual injury, keeping quality in storage, etc.

The freezing point of different apples varied somewhat, the average of all the varieties, both eastern and western grown, being 28.5° F., with a maximum of 29.4° and a minimum of 27.8°. Cooling apples below their freezing points without the formation of ice in the tissues did not cause any visual injury or softening of the fruit. By undercooling isolated apples it was possible at times to carry them at 7 or 8° below their freezing point without ice formation, provided the fruit was left undisturbed. The bruising of apples while they are hard frozen resulted in a much more serious injury than a similar pressure on unfrozen fruit. As a consequence the authors suggest that handling of frozen apples will usually result in more or less severe bruising injury. Bruises made on apples before they are frozen do not become more serious as to depth when the fruit is frozen, nor do they change materially in appearance. No significant differences were observed in the depth of bruises on hard-frozen fruit when subjected to different thawing temperatures.

The point to which the internal temperature of an apple must be reduced before visual injury occurs was found to vary widely with the time of exposure to the temperature, with the variety, and with the individual apple. Wrapping fruit served to hinder the loss of heat from fruit under freezing conditions, and thereby delayed the formation of ice in the fruit tissues. Repeated freezing and thawing of apples caused a progressive increase in the freezing injury, though not so great an increase as a prolonged continuous exposure. The temperature at which apples are ordinarily thawed are said to have only a slight effect upon the subsequent condition of the fruit. There was found to be a distinct weakening in the keeping quality of the apples when they had been frozen, even when there was no visual evidence that freezing had occurred.

Oiled paper and other oiled materials in the control of scald on barrel apples. C. BROOKS and J. S. COOLEY (*Jour. Agr. Research* [U. S.], 29 (1924), No. 3, pp. 129-135).—In continuation of previous investigations on the control of apple scald through the use of oiled wrappers (E. S. R., 50, p. 841), a report is given of experiments in which various materials were tested for the control of scald in barrel apples. Oiled barrels and oiled liners reduced scald on the outside apples but had little effect upon the package as a whole. Oiled straw, shredded oiled paper, and layers of oiled wrappers gave practically as good scald control as wrapping the apples in oiled paper. The success of these various treatments is believed to depend on the thoroughness with which the oiled material is distributed in the package. Shredded oiled paper is considered to furnish the most promising method of scald control for apples in barrels.

Diseases of stone fruits on the market. D. H. ROSE (*U. S. Dept. Agr., Farmers' Bul.* 1435 (1924), pp. II+17, figs. 7).—A description is given of a number of diseases of stone fruits, particular attention being given to the market phases of the problem, but field phases are treated when reference to them helps to explain the conditions which may arise during the marketing process.

Studies on banana anthracnose. R. A. TORO (*Jour. Dept. Agr. Porto Rico*, 6 (1922), No. 4, pp. 23, pls. 5).—Banana anthracnose (*Gloeosporium musarum*), said to have been originally described from Australia, first reported in the United States in 1892, and probably first introduced into Porto Rico some time before it was reported in 1918, is important, so far as this island is concerned, chiefly or only in connection with shipping and marketing, as this condition affects returns in both northern and southern markets.

Even when inoculated from the same culture the spores show great differences in size from different varieties. The behavior of different forms in a culture medium furnished a more definite clue for separation between them. Spores throw out one or two germ tubes, which usually remain single celled. Appressoria form in contact with the glass slides.

Other hosts which may be attacked are cowpea, mango, avocado, and guava. Tomato gave doubtful results.

The mycelium contains a substance which dissolves the parenchyma tissue of mature bananas, but does not affect unripe bananas or epidermal cells of mature or immature fruit.

Susceptibility or resistance does not depend on the tannin content of the peel. Possibly mechanical injury is followed by a change in the chemical composition, developing sugar in the peel. Dryness and coolness, which are essential to measures intended to lower injury, require methods securing adequate aeration.

Observations on diseases of coffee and trees used for shade [trans. title], F. D. KERN and H. H. WHETZEL (*Rev. Agr. Puerto Rico*, 13 (1924), No. 1, pp. 7-11, figs. 2).—The most important disease observed in coffee trees was a root rot supposedly due to at least one fungus and associated, usually, with one resembling *Rosellinia* sp. in the crown or roots. The gradual introduction and growing of resistant trees is regarded as a practical measure. A suspected disease of guava, used for shade in coffee plantations, may be due solely to a borer.

Progress report on big bud and reversion of black currants. A. H. LEES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, pp. 69-72).—The author points out that general conclusions as to this work, previously noted (E. S. R., 49, p. 649; 51, p. 52), can not yet be drawn further than to state that, as regards reversion, the number of new infections has decreased each year,

and there is no evidence that reverted bushes act as sources of infection. As regards big bud, a vigorous removal of big buds in the winter considerably reduces the infection the following year, even with bad cases, and mildly attacked bushes show no appreciable reduction of crop.

The structure of reverted black currants, W. F. F. RIDLER (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, pp. 73, 74).—The work of Lees (E. S. R., 49, p. 649), describing a method for the purpose of identifying cases of black current reversion, has been followed up to ascertain whether there be differences between reverted and normal plants that can be reliably or decisively correlated with presence or absence of the disease. For this purpose a large number of normal and reverted plants were examined in considerable detail, sections being cut from every part of the plants, which were grown at Long Ashton, and included Edina, Seabrook Black, Boskoop Giant, and Baldwin.

“Briefly, the main differences showing to a greater or lesser extent all through the plant are a reduction in the amount of wood and a consequent increase in medullary ray tissue, coupled with a tendency to produce more gum in the reverted plant than in the normal.”

A leaf and corm disease of gladioli caused by *Bacterium marginatum*, L. McCULLOCH (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 4, pp. 159–177, pls. 5, fig. 1).—A detailed account is given of investigations on the bacterial disease of gladiolus due to *B. marginatum*, a preliminary account of which has been noted (E. S. R., 45, p. 752). This disease has been under observation for a number of years and has been found in the District of Columbia, Michigan, Ohio, Pennsylvania, Maryland, Virginia, Florida, California, and Indiana. The leaf injuries vary from minute, reddish spots to large, brownish areas occurring abundantly on the lower part of the leaves. Infected corms are more or less disfigured by circular, shallow depressions. These are usually brown in color, horny or brittle in texture, and exude a gummy substance. Isolations of the organism have been made from the different parts of the plant, and its pathogenicity established by inoculation experiments.

There is said to be evidence that the organism remains alive in the soil in which diseased plants have been grown. Crop rotation should be practiced. Control measures have not been sufficiently developed to warrant recommendation, but considerable success has resulted from treating the corms with corrosive sublimate or formalin solutions.

The depth distribution of the root-knot nematode, *Heterodera radicola*, in Florida soils, G. H. GODFREY (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 2, pp. 93–98, figs. 5).—The results are given of a study designed to determine the relative root-knot nematode content of certain soils at different depths and at different seasons. Samples of soils at desired depths were taken and placed in flower pots in which tomato seedlings were planted. The occurrence of the nematodes was based on an estimate of the relative number of knots produced on the tomato roots. It was found that the nematodes are often very numerous to a depth greater than that ordinarily reached by plows, and considerable variation from one spot to another and from one month to another was found in the depths of the regions of maximum infestation. A number of factors are believed to influence the distribution, among them the depth penetration of infested roots, the relation of the time of taking soil samples to a period of heavy rainfall, the height of the water table, and the type of the soil and the subsoil. The influence of these factors may be so great as to overcome any seasonal change, such as would occur between one month and the next. During the winter months a considerable reduction in the total root-knot nematode content of the soil is said to be evident.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Herons of the United States, T. G. PEARSON (*Natl. Assoc. Audubon Soc.* *Bul.* 5 (1924), pp. 38, pls. 4, figs. 12).—This is a semipopular account of the herons in this country, there being 17 species and subspecies of the family Ardeidae in the United States.

Some insecticidal properties of the fatty acid series, E. H. SIEGLER and C. H. POPENOE (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 5, pp. 259-261).—The authors show that, contrary to existing theories, the fatty acid radicals of soaps rather than the alkaline constituents are responsible for their insecticidal value, the fatty acids freed through hydrolysis of soaps in dilute solution providing the toxic principle. Experiments so far conducted indicate that the toxicity of the fatty acids increases with the molecular weight, at least to a certain point not yet definitely determined. The peak of toxicity in the fatty acid series appears to lie near capric acid. Capric acid killed more than 99 per cent of the apple aphid at a dilution of 1 to 1,200, lauric acid killed 92 per cent at the same dilution, and myristic acid 78 per cent. Paralysis is complete and practically immediate when aphids are subjected to toxic strengths of the fatty acids. In tests on the black chrysanthemum aphid (*Anuraphis sanborni* Gill.) the mortality caused by nicotine sulfate was indicated by the large percentage of dead aphids which dropped from the sprayed plants, while with the fatty acids the dead insects remained attached by their inserted beaks, affording no gauge of toxicity until the actual counts were made.

The fatty acids showed unusual wetting and spreading powers when applied in the emulsion form to either insects or foliage, wetting readily such insects as the polished black aphids, the squash bug, and hairy caterpillars. Leaves having a waxy covering, such as nasturtium and cabbage, were found to be easily and evenly coated. The physiological action of the fatty acids on the insect organism is as yet undetermined. Experiments so far conducted indicate that the toxicity of the fatty acids increases with the molecular weight, at least to a certain point not yet definitely determined. No variation in toxicity is experienced under varying summer temperatures and humidity, thus differing from the action of nicotine. No injury to chrysanthemum plants was shown by dilutions fatal to the black chrysanthemum aphid, but the foliage of nasturtium is injured by the dilutions required to kill the bean aphid.

Tests toward the practical application of the insecticidal properties as shown by preliminary work with the long-chain fatty acids resulted in the selection of a product commercially known as "double distilled coconut fatty acids" as the most promising. Difficulties in the preparation of a stock solution and the retention of the insoluble acids in a stable emulsion have been met by the addition of an equal amount of benzol gasoline to the commercial fatty acids, afterwards using powdered glue as a colloidal stabilizer. When used in tests in the proportions of 1 part of the coconut fatty acids to from 800 to 1,200 parts of water, a mortality rate of from 94 to 98 per cent of the apple aphid was obtained, equivalent to the rate obtained with commercial 40 per cent nicotine sulfate in parallel tests at the same dilutions.

"The spreading power of the emulsion is excellent, toxicity high, and cost of material extremely low. Prepared by this formula, coconut fatty acids have compared favorably in efficiency, pound for pound, in the experiments so far conducted, with commercial nicotine preparations at less than one-fourth the cost per gallon of spray mixture."

Oil sprays: Their preparation and use for insect control, A. L. MELANDER, A. SPULER, and E. L. GREEN (*Washington Col. Sta. Bul.* 184 (1924), pp. 31).—This is a summary of information on oil sprays based upon work conducted in continuation of that previously noted (E. S. R., 51, pp. 157, 158).

The so-called neutral type of lubricating oil gave the best results in experiments with dormant sprays in 1924. Heavier oils apparently lack penetration, and lighter oils do not have sufficient body. Used crank case oil is not dependable because of its uncertain composition. Some proprietary oils have not been efficient, and others vary in composition from year to year. The authors consider cresoap, made from potash fish-oil soap and cresylic acid, to be the best emulsifier for miscible oil. A miscible oil which requires no boiling, pumping, or complicated equipment in its preparation is composed of lubricating oil and cresoap, 90 and 10 per cent by weight or 91 and 9 per cent by volume, respectively. It can not freeze, does not spoil on standing, and in field tests has given better results than any other oil spray, its increased efficiency more than making up for its greater cost. Caseinate spreader and glue are considered the best nonsoap emulsifiers for emulsion stocks. It was found that kerosene can be emulsified more easily with cresoap or caseinate than with boiling soap. Emulsion stocks should not be made to contain more than 75 per cent of lubricating oil or 67 per cent of kerosene, or a reversed emulsion will result which will not mix with water.

If a spray emulsion breaks, the watery portion may be too weak to be effective and the oily scum is injurious if sprayed on trees. It is pointed out that soap emulsions should be used where the water is soft or alkaline, and non-soap emulsions where the water is hard. The dormant sprays of lubricating oil should be applied when buds begin to swell in early spring. Sprays for scale insects should contain 4 per cent of actual oil, and for leaf roller 8 per cent, a 2 per cent oil spray being too weak for the San José scale under Washington conditions. As a summer spray, 1 per cent of oil is useful for red spiders and for crawlers of scale, but is not strong enough for old scale or aphids. Summer sprays containing more than 1 per cent of oil may cause spray burn if used in very hot weather or on delicate plants. A trouble chart for oil sprays is included.

Work with lubricating oil emulsions by Yothers et al. in Florida (E. S. R., 39, p. 160; 43, p. 157; 50, p. 239); Quaintance (E. S. R., 47, p. 453), Ackerman (E. S. R., 49, p. 354), and Isely (E. S. R., 51, p. 552) in Arkansas; Flint (E. S. R., 49, p. 355) and Carver and Compton (E. S. R., 51, p. 361) in Illinois; Davis in Indiana (E. S. R., 51, p. 361); Haseman and Sullivan (E. S. R., 49, p. 253) and Burroughs (E. S. R., 50, pp. 51, 657) in Missouri; Newcomer in Washington (E. S. R., 50, p. 844); Weigel and Broadbent (E. S. R., 52, p. 61); and Sullivan and McBride (p. 658) has been noted.

Making oil sprays, A. L. MELANDER (*Wash. State Col. Ext. Bul.* 129 (1925), pp. 10).—This is a summary of the bulletin noted above.

Loss of nicotine from nicotine dusts during storage, C. C. McDONNELL and H. D. YOUNG (*U. S. Dept. Agr. Bul.* 1312 (1925), pp. 15, figs. 13).—The results of investigations conducted by the Bureau of Chemistry are here presented, in large part in tabular and chart form.

The rate of loss of nicotine from nicotine sulfate dusts prepared with kaolin, kieselguhr, talcum, plaster of Paris, calcium hydroxide, and calcium carbonate took place in the order named. Dusts made with free nicotine solution lose their nicotine much more rapidly than those made with nicotine sulfate. Air-tight metal or glass containers only should be used for packing the dusts. A rapid loss of nicotine from plaster of Paris-nicotine sulfate dusts is thought to

have been due to the presence of calcium carbonate as an impurity in the plaster of Paris. Nicotine sulfate solutions became concentrated to about 45.5 per cent nicotine, owing to evaporation, when they were exposed to the air at room temperature, but with little or no loss of nicotine. Under the same conditions solutions of free nicotine lost, in addition to water, from 10 to 17 per cent of the nicotine originally present, and reached a concentration of 89 per cent nicotine, which remained unchanged under the conditions of the test.

The preparation from tobacco of a solution for spraying, O. M. SHEDD and A. J. OLNEY (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 650-656).—This is a contribution from the Kentucky Experiment Station, in which the authors state that common tobacco trash is the only grade of Kentucky tobacco, other than stems and stalks, that can be used profitably at present prices for making a spray solution. It has a wide variation in nicotine content, ranging in 79 samples of white Burley and dark tobacco from 0.26 to 4.50 per cent in the air-dry trash. Infusions made from 26 samples of trash, using such quantities of cold water as would give from 0.05 to 0.07 per cent of nicotine in the solution, as computed from analyses of the samples, were about equally effective in exterminating aphids. Lower concentrations were not as satisfactory.

Blackleaf 40 solution diluted to contain 3.5 per cent of nicotine did not injure tomato plants. Higher concentrations caused injury, which was partly preventable by soap.

Lead arsenate, lime sulfur, and tobacco dust as a triple spray mixture, L. R. STREETER (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 656-658).—This is a brief report of work at the New York State Experiment Station conducted in connection with the investigation previously noted (E. S. R., 52, p. 501).

[Economic insects and their control in Pennsylvania] (*Penn. Dept. Agr. Buls.* 383 (1924), pp. 10, figs. 3; 386, pp. 7, figs. 7; 390, pp. 19, figs. 6, insert, pp. 2, fig. 1).—These practical summaries of information deal, respectively, with P D B (Paradichlorobenzene) and Other Controls for the Peach Tree Borer, by T. L. Guyton and J. R. Stear; The Round-headed Apple Tree Borer, by T. L. Guyton and J. N. Knull; and The Japanese Beetle in Pennsylvania, by C. H. Hadley.

New termites and hitherto unknown castes from the Canal Zone, Panama, T. E. SNYDER (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 4, pp. 179-193, pls. 2, figs. 9).—While in the Canal Zone in February, 1924, two types of soldiers of similar form, belonging to the new subgenus *Uniformitermes* of the genus *Nasutitermes* Banks, were collected by the author. New species were found in two rare American genera, namely, *Cylindrotermes* and *Armitermes* (Rhynchotermes). In addition to biological notes, descriptions are given of seven new species. A list of the 36 termites, representing 15 genera, known to occur in the Canal Zone and near-by Panama is included.

The comparative resistance of woods to the attack of the termite, *Cryptotermes brevis* Walker, G. N. WOLCOTT (*Porto Rico Dept. Agr. and Labor Sta. Bul.* 33 (1924), pp. 15).—It is pointed out that of 13 species of termites at present known in Porto Rico, only 2 are sufficiently common to be of economic importance. *Nasutitermes morio* Latr., which builds large, rounded, dark-brown nests on the ground, on trees or posts, or in buildings, is controlled by destroying the main nest. This is accomplished by breaking open the top, or the main tunnels, of the nest and placing therein about a tablespoonful of a stomach poison, such as Paris green, arsenate of lead, or calomel.

The other common termite, *C. brevis* Wlk., which destroys furniture and the woodwork of houses, is a much more serious pest, since it builds no external

nest, and usually the only indication of its presence is the excrement, consisting of minute pellets, which appears beneath infested wood. So far as observed, it attacks only seasoned wood and usually that protected from rainfall. In tests conducted, extending over nearly a year, the details of which are presented in tabular form, it was found that mahogany and cypress are the two woods most desirable for use in resisting the attacks of termites.

"Mahogany is not entirely resistant, but cypress, at least in these experiments, has proved absolutely so, and appears to be almost as safe from termite attack as creosoted wood. Maga, cobana, ortegón, ausubo, mangrove, and black walnut also prove to be desirable woods, while, quite surprisingly, California redwood is not as resistant as genuine white pine, or as yellow cedar. Cedro is far down the list, and eucalyptus, despite its odor, is one of the woods preferred by termites. Sitka spruce is preferred to almost any other wood and is consequently the least desirable wood that can be used for construction in Porto Rico. . . . While creosoting any wood makes it unattractive to the termites, it does not protect it from attack on any of its uncovered surfaces."

A list is given of 50 woods tentatively arranged in order of their resistance.

Tree cricket injury to prunes, M. A. YOTHERS (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 661, 662, pl. 1).—This is a brief account of injury by *Oecanthus* spp., which when about two-thirds grown begin feeding on half-grown prunes, gnawing holes on the surface and often deep down into the fruit. During the past few years they have become one of the most important insect enemies of the prune in southern Idaho.

Studies in the control and biology of capsids on apple trees [trans. title], S. ROSTBUP and M. THOMSEN (*Tidsskr. Planteavl*, 29 (1923), No. 3, pp. 395-461, figs. 11).—This is a report of experiments in Denmark, in which a spray containing 0.1 per cent of nicotine with 1 per cent of soap was used with a view to determining the most suitable time for application. The experiments of 1919 are said to confirm the conclusion reached in the three preceding years, that the second spraying, just prior to blossoming, is most efficacious against the capsids, the first being too early and the third practically neutral. An account of the biology of *Plesiocoris rugicollis*, the main cause of the injury, and *Lygus pabulinus* is included and reference is made to several other species of importance.

Calcium cyanide dust for control of the grape leaf hopper, H. J. QUAYLE (*Jour. Econ. Ent.*, 17 (1924), No. 6, p. 668).—This is a brief report of experimental work at the Citrus Experiment Station, Riverside, Calif., in 1923 and 1924, with the overwintering grape leafhoppers. The author finds that when calcium cyanide dust is blown into the vine the leafhoppers are quickly overcome and fall to the ground. If there are no cyanide particles on the ground the hoppers will recover, but if there is a slight deposit of the cyanide on the ground sufficient gas will be given off to prevent their recovery.

Causes of fluctuation in numbers of beet leafhoppers (*Eutettix tenella* Baker) in a natural breeding area of the San Joaquin Valley in California, H. H. P. SEVERIN (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 639-645).—The author reports that the primary cause for the enormous reduction in numbers of the spring brood of beet leafhoppers during 1923 was the early drying of the pasture vegetation during March, instead of April and May as in previous years from 1919 to 1922. Secondary factors which reduce the number of leafhoppers in a natural breeding ground are natural enemies, spring and summer migrations, fungus diseases, and rainfall.

The effects of oil spray on apple aphids, K. C. SULLIVAN and O. C. McBRIDE (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 658-660).—Experiments conducted with the apple-grain aphid in Missouri indicate that neither lime sulfur

nor lubricating oil emulsions can be recommended for complete control of apple aphids.

A bacterial disease of silkworms, R. W. GLASER (*Jour. Bact.*, 9 (1924), No. 4, pp. 339-355, figs. 4).—In this contribution from the department of animal pathology of The Rockefeller Institute for Medical Research, at Princeton, N. J., an account is given of a bacterial disease which appeared and rapidly assumed epidemic proportions among the author's silkworm cultures. The external appearance of diseased living and dead worms is described, and an account of the histo-pathology of the disease is given. A bacillus was isolated from the feces, blood, and various tissues of diseased living and dead worms, which has been demonstrated to be the causative agent. The investigations show that dying and dead worms infect the food of normal silkworms by means of the feces and body fluids. Some evidence is advanced to show that the disease-producing bacillus is not transmitted from generation to generation through the egg. The possible relation of this disease to the flacherie-like affections of silkworms is mentioned, and its distinctness from pébrine, muscardine, and the polyhedral disease, also termed "jaundice," "gelbsucht," or "grasserie," is emphasized.

The greenhouse leaf-tyer, *Phlyctenia rubigalis* (Guenée), C. A. WEIGEL, B. M. BROADBENT, A. BUSCK, and C. HEINRICH (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 3, pp. 137-158, pls. 2, figs. 3).—This is a report of studies of the life history and habits of and control measures for one of the more important enemies of chrysanthemum, cineraria, snapdragon, rose, violet, and many other ornamental and greenhouse plants. In several instances its attack has resulted in complete destruction of the plants. The species, which is of American origin, having been described by Guenée in 1854, has frequently been mistaken for the closely related European species *P. ferrugalis* Hübner.

Nine distinct generations were reared during 1921, indicating that there may be a definite overlapping of generations throughout the year under greenhouse conditions. The destruction of plants is due to the feeding of the larvae, which later increase the injury by tying themselves up in the foliage prior to pupation, thus causing further disfigurement and consequent decrease in commercial value. The pupae are well protected by the formation of the pupal case within tied leaves lined with a rather tough silken cocoon. The adults are nocturnal in habit. A systematic description of the adult and immature stages is by Busck and Heinrich.

Spiders and ants are important enemies, and single records have been made of parasitism by *Synetaeris* sp., *Apanteles glomeratus* L., and *Phorocera parva* Bigot. Control experiments indicate that the adults may be successfully held in check by fumigation for an hour, twice, with an interval of 7 days, with hydrocyanic acid gas at the rate of 1 oz. of sodium cyanide per 1,000 cu. ft. of air space, or by dusting with a 5 per cent nicotine sulfate dust. The eggs were found to be impervious to contact insecticides, the larvae succumbed to the effects of arsenical poisons when applied either in the dry or liquid form, and the pupae were virtually immune from all artificial control measures, except hand picking, because of their protection and resistance. A list of 13 references to the literature cited is included.

Dosing the root borer with paradichlorobenzene, C. J. MCINTOSH (*Better Fruit*, 19 (1924), No. 3, pp. 5, 6, fig. 1).—The author reports that under Oregon conditions this chemical must be applied during late August or early September. Experimental work with spring treatment is under way.

A supposedly beneficial insect discovered to be a citrus pest, A. J. BASINGER (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 637-639).—This is a contribution from the Citrus Experiment Station at Riverside, Calif., in which the

larva of the moth *Holcocera iceryaella* Ril., formerly recorded as a scale predator and a scavenger, is reported to be also a secondary feeder on oranges, causing damage similar to that of *Tortrix citrana* Fer.

The azalea leaf miner (Lepid.: Tineidae), F. M. TRIMBLE (*Ent. News*, 35 (1924), No. 8, pp. 275-279, pl. 1).—This is a brief account of *Gracillaria azaleella* Brants, which is the cause of the loss of leaves on azaleas in greenhouses. The pest is a native of Japan and was imported into this country on azaleas from Belgium and the Netherlands, where it had been received from Japan on young plants, having been first observed by E. P. Felt in New York in 1911. It has since been found in greenhouses throughout Pennsylvania and has been reported many times from other Northern States and Canada. Cyanide fumigation, followed later by alternate night fumigations with nicotine sulfate, is said to control the pest.

Notes on Japanese Lepidoptera and their larvae, VI, VII, A. E. WILEMAN (*Philippine Jour. Sci.*, 19 (1921), No. 2, pp. 209-231, pls. 2; 25 (1924), No. 1, pp. 75-109, pls. 2).—These contributions are in continuation of the work previously noted (E. S. R., 40, p. 456).

The Bombyliidae of the Ethiopian region, M. BEZZI (London: *Brit. Mus. (Nat. Hist.)*, 1924, pp. VIII+390, figs. 46).—This is a monographic account, based upon material in the British Museum (Natural History). Three hundred twelve forms, representing 30 genera, are dealt with. Tables for the separation of, and an index to, the genera and species are included.

Combating the olive fly in Corfu [trans. title], J. SORDINAS (*Redia*, 15 (1924), No. 1-2, pp. 97-103; abs. in *Rev. Appl. Ent.*, 12 (1924), Ser. A, No. 5, pp. 190, 191).—A successful campaign against the olive fly (*Dacus oleae*) in Greece led to the application of the same measures in Corfu in 1921, namely, the application of a modified De Cillis spray containing 900 parts by weight of water to 100 parts of molasses and 3 parts of sodium arsenite. Four applications were made to olive trees throughout the island, at the end of June, July, and August, and from mid-September to early October, with another in the low-lying districts, especially on the coast, where the flies of the third generation may do great damage and even destroy the entire crop.

The work resulted in the preservation of the entire crop and, incidentally, in the destruction of the common flies, mosquitoes, wasps and hornets, and *Lasioptera berlesiana*, another dipterous enemy of olives. The destruction of mosquitoes led to the total absence of malaria in 1921. Bees did not touch molasses containing sodium arsenite. It is reported that in neighboring small islands that were not treated, or incompletely so, between 20 and 100 per cent of the olive crop was lost.

The bee-louse, Braula coeca, in the United States, E. F. PHILLIPS (*U. S. Dept. Agr., Dept. Circ.* 334 (1925), pp. 12).—This summary of information includes a review of the literature in connection with a list of 39 references on *B. coeca*, a minute wingless dipteran which has been introduced into this country from Europe and is known to occur in Carroll County, Md., a small area in south-central Pennsylvania, and at Mankato, Minn. It infests honeybees only, being usually found on worker bees, rarely more than one to a bee, though under some circumstances it may collect in larger numbers on the queen bees. It is not known to damage colonies, and no serious harm is anticipated from its establishment in this country.

The blueberry leaf-beetle and some of its relatives, H. C. FALL and W. C. Woods (*Maine Sta. Bul.* 319 (1924), pp. 81-140, pl. 1, figs. 2).—In the first part of this bulletin (pp. 81-91), Fall presents a systematic account of the New England species of *Galerucella*. A key for their separation is followed by

notes on 16 species, of which 5, namely, *G. kalmiae* on laurel, *G. vaccinii* on blueberry, *G. spiraeae* on meadowsweet, *G. alni* on alder, and *G. perplexa* on willow are described as new.

In the second part (pp. 92-140), Woods deals with the economics and biology of 15 species of the genus *Galerucella*, of which all but 4 have been known to occur in Maine. The biology and control of the blueberry leaf-beetle (*G. vaccinii* Fall) (pp. 93-105), the gray willow leaf-beetle (pp. 105-112), the brown willow leaf-beetle (pp. 112-115), the brown alder leaf-beetle (pp. 115-122), the meadowsweet leaf-beetle (*G. spiraeae* Fall) (pp. 122-127), and the laurel leaf-beetle (*G. kalmiae* Fall) (pp. 127-133) are considered at length, and brief notes are given on the other species, including the cherry leaf-beetle (*G. cavicollis* LeC.), the azalea leaf-beetle, the pond-lily leaf-beetle (*G. nymphaeae* L.), the elm leaf-beetle (*G. xanthomelaena* (*luteola*)), the smooth goldenrod leaf-beetle, *G. americana* Fab. and *G. conferta* LeC., the boneset leaf-beetle, and the ragweed leaf-beetle.

Longevity and fecundity of *Bruchus quadrimaculatus* Fab. as influenced by different foods, A. O. LARSON and C. K. FISHER (*Jour. Agr. Research* [U. S.], 29 (1924), No. 6, pp. 297-305).—The authors find that the weevil *Mylabris quadrimaculatus*, officially known as the four-spotted bean-weevil, in its normal condition in the warehouse lives a shorter time without food than when it has access to water or sweetened water. The difference in the average length of life of the weevils receiving no food and those receiving water varied from less than 3 days with the lone males to 11 with the lone females. Access to water lengthened the lives of the pairs about 10 days, and sugar water lengthened their lives from 13 to 27 days as an average for different groups of weevils. Access to water increased the average number of eggs laid by about 30 per cent, and access to sugar water about 50 per cent.

"Food reduced the number of eggs laid during the first few days of oviposition, but lengthened the time over which eggs were laid. Viable eggs were laid over twice as great a period of time by weevils receiving sugar water as by those without food. Frequent mating, such as occurs normally under storage conditions, reduced the length of life of both males and females. Females which mated only once during the first few hours after emergence deposited large numbers of fertile eggs. Virgins deposited only small numbers of infertile eggs and in no case produced fertile eggs."

Fumigation against grain weevils with various volatile organic compounds, I. E. NEIFERT, F. C. COOK, R. C. ROARK, W. H. TONKIN, E. A. BACK, and R. T. COTTON (*U. S. Dept. Agr. Bul. 1313* (1925), pp. 40, fig. 1).—This is a report of investigations conducted cooperatively by the Bureaus of Chemistry and Entomology, in which the action of 100 organic compounds was tested on several species of weevils under conditions permitting a control of the factors of concentration, time, and humidity, and with observations of the temperature.

Thirty compounds which were more toxic to the rice weevil than carbon disulfide include 2 of 8 bromides tested, 3 of 15 chlorides, the only iodide tested, 1 alcohol of 8 alcohols and phenols, 3 of 4 aldehydes, 2 of 4 ketones, both of the chlorine-substituted ketones tested, 1 of 2 chlorohydrins, 5 of 9 esters, 4 of 12 sulfur compounds, 1 nitrile of 5 nitriles and isonitriles, both of the nitrites tested, 2 of 8 amines, and pyridine. The relative toxicity of the different classes of compounds can not be given because the low volatility of several of those tested gave only very low vapor concentrations.

"As a class, the hydrocarbons showed the lowest insecticidal efficiency, not one of the 8 tested equaling carbon disulfide in fumigating power. The most effective fumigant in the glass-jar tests was epichlorohydrin, which killed the

rice weevil at a concentration of 0.09 per cent, equivalent to 8.23 lb. per 1,000 cu. ft. It was, however, an unsatisfactory fumigant in the presence of grain. There is no constant relationship between the boiling points and the lethal concentrations of the compounds killing 100 per cent of the rice weevils after exposure for 24 hours."

Ethyl formate and ethyl acetate were the only promising fumigants for grain in box cars, the acetate costing only about one-third as much as the formate. It was found that a pure grade of ethyl acetate leaves practically no odor in the fumigated grain or in the bran or shorts made from the grain, and none in the flour or in the bread baked from the flour. Under practical fumigating conditions the insecticidal efficiency of ethyl acetate is increased by the addition of carbon tetrachloride. Next to carbon disulfide, the most effective fumigant for weevils in wheat in grain cars under practical fumigating conditions is a mixture of about 40 volumes of ethyl acetate and about 60 volumes of carbon tetrachloride, which is noninflammable at ordinary temperatures. The proper dosage of this mixture for fumigating box cars is about 45 lbs. per 1,000 cu. ft. It is pointed out that both the ethyl acetate and carbon tetrachloride must be tested to be sure that they are from odoriferous constituents of low volatility before they are used in fumigating grain.

The work includes a list of 26 references to the literature cited.

Ethyl acetate-carbon tetrachloride mixture, E. A. BACK and R. T. COTTON (*Jour. Econ. Ent.*, 17 (1924), No. 6, p. 663).—This relates to the investigations noted above.

Application of the Röntgen tube to detection of boring insects, N. YAGHI (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 662, 663).—This is a contribution by an entomologist of the Government Agricultural Experiment Station at Tokyo, Japan, in which it is stated that he has used the Roentgen tube for the detection of boring insects in their food substances with success.

Another lead boring beetle, W. J. CHAMBERLIN (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 660, 661, fig. 1).—The author presents notes on a species of *Callidium* occurring in Oregon.

Studies of the parasites of the alfalfa weevil in Europe, T. R. CHAMBERLIN (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 623-632).—This is a brief account of a study of the parasites of the alfalfa weevil made by the author in Europe between August, 1921, and August, 1923. Fourteen primary parasites were encountered, the habits and distribution of which are briefly considered. It is concluded that most of the more important forms can withstand a climate similar to that of Utah, and that it is advisable to attempt the colonization of the more promising.

The brown vegetable weevil (*Listroderes (Desiantha) nociva*), T. McCARTHY (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 8, pp. 573-580, figs. 2).—This is a report of studies of the pest in Australia, recent accounts of which in the United States by Bynum (*E. S. R.*, 49, p. 761), Harned (*E. S. R.*, 48, p. 852), and Chittenden (*E. S. R.*, 50, p. 57) have been noted.

Injuries to peppers in California by *Anthonomus eugenii* Cano, R. E. CAMPBELL (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 645-647).—The pepper weevil was found in November, 1923, to be present in several pepper fields in southern California, this being the first record of its occurrence in that State. It was most abundant during November and December, when practically all of the late peppers in infested fields were destroyed. The injury to the pods resulted in decay, which usually started in the seed cluster, and in small peppers the growth was checked and the pods distorted.

An enemy of the olive in Japan, *Hylobius perforatus* Roel. (Col., Curculionidae) [trans. title], R. POUTIERS (*Bul. Soc. Ent. France*, No. 3

(1924), pp. 47, 48; *abs. in Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 2 (1924), No. 2, p. 473).—The larva of the curculionid *H. perforatus* excavates galleries of increasing size, at times completely encircling the young olive branches, which wither and die.

Report of the Maryland State Beekeepers' Association (*Md. Agr. Soc., Farm Bur. Fed., Rpt.*, 8 (1923), pp. 318-346).—Included in this report is an account of Beekeeping in the Northwest, by E. F. Phillips (pp. 322-330); of Commercial Beekeeping, by J. I. Hambleton (pp. 330-337); of Comb Honey Production, by N. W. James (pp. 337-340); and a discussion on How Shall We Market Our Honey in Maryland? by G. Harrison, jr. (pp. 340-346).

The presence of the Argentine ant in Valencia [trans. title], R. FONT DE MORA (*Bol. R. Soc. Españ. Hist. Nat.*, 23 (1923), No. 2, pp. 77, 78; *abs. in Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 3, p. 780).—This pest is said to have appeared in the neighborhood of Valencia, Spain, and already to have become very common in the orange grooves, where it increases the injury caused by at least four coccids. It is not infrequently found in the gardens and nurseries.

New chalcidids from France [trans. title], R. GARCÍA MERCET (*Bol. R. Soc. Españ. Hist. Nat.*, 22 (1922), No. 9, pp. 396-402, figs. 4; *abs. in Internatl. Rev. Sci. and Pract. Agr.* [Rome], n. ser., 1 (1923), No. 3, pp. 782, 783).—Descriptions are given of *Tetrastichodes platanellus* n. sp., a parasite of the microlepidopteran *Lithocolletis platani*, and *Coccidencyrtus poutiersi* n. sp., parasitic on *Howardia zamiae*, in France.

Polyscelis modestus Gahan, a minor parasite of the Hessian fly, P. R. MYERS (*Jour. Agr. Research* [U. S.], 29 (1924), No. 6, pp. 289-295, figs. 2).—This is a report of observations of a parasite of the Hessian fly, first collected near Hanover, Pa., in 1915, and later reared from material collected in five additional localities in north-central Maryland and southeastern and south-central Pennsylvania. The species, which was described by Gahan in 1922 as new (*E. S. R.*, 48, p. 59), is of minor importance, not having been recovered since 1918. It attacks and destroys both the larvae and the pupae of the Hessian fly, as also the larvae and probably the eggs and pupae of its own species. It is occasionally hyperparasitic, probably on *Platygaster vernalis* (Myers). Females reproducing parthenogenetically are arrhenotokous. Before consumption by the parasite, the internal contents of the Hessian fly larvae undergo a process of liquefaction. This is thought to be caused by the injection of a secretion by the primary parasitic larva.

Adirus trimaculatus Say, a rose pest, A. B. CHAMPLAIN (*Jour. Econ. Ent.*, 17 (1924), No. 6, pp. 648-650).—The author finds *A. trimaculatus*, a sawfly of the family Cephidae known as a borer in blackberry canes in the larval stage, to cause similar injury to rose stems in Pennsylvania.

FOODS—HUMAN NUTRITION

The digestibility of tepary beans, H. J. DEUEL (*Jour. Agr. Research* [U. S.], 29 (1924), No. 4, pp. 205-208).—Following the usual methods employed in the extensive series of digestion experiments conducted at the Office of Home Economics, U. S. D. A. (*E. S. R.*, 51, p. 60), a study was made of the digestibility of tepary beans (*Phaseolus acutifolius*) for purposes of comparison with other legumes such as navy and kidney beans.

The beans were prepared by soaking overnight and cooking for an hour under 15 lbs. pressure and were eaten with a basal diet of bread, butter, fruit, and sugar. The beans supplied on an average 40 gm. of protein and 99 gm. of carbohydrate per man per day. The average results obtained

with the five subjects were as follows: Digestibility of the entire ration—protein 80.3, fat 93.2, carbohydrate 97.8, and ash 74.6 per cent; estimated digestibility of the tepary bean—protein 75.9 and carbohydrate 98 per cent. These values correspond closely to those reported by Wait (E. S. R., 19, p. 163) for the protein of navy and red kidney beans (78 per cent) and by Mendel and Fine (E. S. R., 26, p. 564) for the protein of navy bean (77.9), and are somewhat higher than the value (96 per cent) reported by Wait for navy bean carbohydrate.

A list of 31 references to the literature is appended.

Vitamin A content of fresh eggs, J. C. MURPHY and D. B. JONES (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 5, pp. 253-257, figs. 4).—In this contribution from the Bureau of Chemistry, U. S. D. A., data are reported on the content of vitamin A in fresh eggs laid during the summer months by hens which had access to plenty of fresh green food.

The experiments were conducted on young rats, using both preventive and curative tests. In the former 0.75 gm. daily of egg proved adequate for normal growth and 0.5 gm. for growth at somewhat less than the optimal amount. In the curative experiments the rats were fed a vitamin A-free basal diet until the development of ophthalmia and were then fed the egg in different amounts. With 0.5 gm. there was prompt cure of ophthalmia and restoration of growth. With 0.25 gm., the time required for the cure of ophthalmia was somewhat longer and the rats made slightly poorer growth. With 0.1 gm., the growth recovery approximated that with 0.25 gm., but this amount proved insufficient to cure ophthalmia in some cases. The amounts of egg yolk corresponding to 0.75, 0.5, and 0.25 gm. of whole egg are calculated to be about 0.26, 0.17, and 0.088 gm., respectively. Attention is called to the fact that the amount required for growth approximates closely the 0.25 gm. reported by Hess to be the protective dose for rickets (E. S. R., 50, p. 165). It is further calculated that a little more than 0.05 gm. of the oil of egg yolk would be required for promoting growth and 0.025 gm. for curing ophthalmia. This is thought to indicate that egg oil has a vitamin A potency of between 2 and 4 per cent of that of the most potent cod liver oil.

The effect of long-continued storage at low temperature on the vitamin-A content of eggs, D. B. JONES, J. C. MURPHY, and O. MOELLER (*Amer. Jour. Physiol.*, 71 (1925), No. 2, pp. 265-273, figs. 2).—In this study the vitamin A content of eggs which had been stored in a frozen condition for 9 years was compared with that of fresh eggs as noted in the above paper.

No difference could be detected between the fresh and storage eggs except in the smallest amount fed, 0.1 gm. In this amount the fresh eggs appeared to be slightly more potent than the storage. The differences were, however, so slight as to be of little significance. It is concluded that no appreciable deterioration in the vitamin A content of eggs takes place on prolonged storage in a frozen condition.

Hydrogen ion concentration in the human duodenum, H. V. HUME, W. DENIS, D. N. SILVERMAN, and E. L. IRWIN (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 633-645, fig. 1).—This paper reports electrometric determinations of the H-ion concentration of the human duodenum at frequent intervals before, during, and after the ingestion of considerable amounts of milk, cream, eggs, and crackers, respectively. The determinations were made by inserting a specially modified Hildebrand electrode in a duodenal fistula.

The minimum, maximum, and average pH values obtained in the four experiments were as follows: Milk 6.59, 7.33, and 6.91; cream 6.66, 7.91, and 7.17; egg whites 5.90, 7.65, and 6.95; and starch 6.19, 8.23, and 7.07, respec-

tively. These results are thought to indicate that the reaction of the duodenum is not affected by the type of food ingested.

Interesting observations were also made on the time of appearance of fragments of food in the liquid exuding from the fistulous opening. The approximate time of appearance of the different foods was starch 19 minutes, cream 31, egg white 37, and milk 41 minutes, respectively.

Animal calorimetry.—[XXV], The relative specific dynamic action of various proteins, D. RAPPORT (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 497-511, fig. 1).—In this continuation of the series of studies on animal calorimetry by Lusk and his coworkers (E. S. R., 51, p. 558), the specific dynamic action of beef, gelatin, casein, gliadin, codfish, and chicken was determined by the usual methods. These materials were selected on account of the extreme differences in their content of glycine and alanine, amino acids considered of special significance in specific dynamic action.

When given to dogs in portions each of which contained 6 gm. of nitrogen, these proteins showed practically the same specific dynamic action, although gelatin contains about 26 per cent of glycine and 9 per cent of alanine and casein approximately no glycine and 1.5 per cent of alanine.

The specific dynamic action of a mixture of gelatin and cystine was also determined in order to see whether there might be an increase in the heat produced from the formation of glutathione. No such effect was noted.

These results indicate that the specific dynamic action of proteins of varied amino acid content is not proportional to their content of glycine and alanine.

Animal calorimetry.—[XXVI], The interrelations between certain amino acids and proteins with reference to their specific dynamic action, R. WEISS and D. RAPPORT (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 513-544, figs. 6).—In an attempt to explain the results reported in the previous paper the specific dynamic action was determined of various proteins alone and combined with glycine or alanine, and with other proteins.

Casein and glycine together showed no greater specific dynamic action than casein alone. Similarly, gelatin and glycine in an amount equal to the glycine content of gelatin had no greater specific dynamic action than gelatin alone. With glycine and a smaller amount of gelatin and with the same amount of gelatin and a larger amount of glycine there was a summation of effect. The specific dynamic action of alanine with casein or gelatin was no greater than that of the proteins alone.

With increasing quantities of beef there was an increase in the specific dynamic action proportional to the amount of protein metabolized. Meat and casein together were equivalent in specific dynamic action to the sum of both separately. Glycine and alanine together had a greater effect than either alone, but with glycine, alanine, and gelatin the effect was practically the same as with gelatin alone.

Evidence was also obtained that the absence of summation was not due to delay in intestinal absorption, and that the reactions which neutralize the effect of amino acids when combined with protein may occur in the blood or in the tissues outside of the gastrointestinal tract. It is concluded that other factors than the direct influence of the amino acids glycine and alanine contribute to or modify the specific dynamic action of protein. The possibility is suggested that gelatin and casein yield certain amino acids or polypeptides which react with glycine to neutralize its specific dynamic effect.

Fat excretion.—II, The quantitative relations of the fecal lipoids, W. M. SPERRY and W. R. BLOOR (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 261-287).—In continuation of the investigation previously noted (E. S. R., 48, p. 161), the

lipoid material of the feces of cats and dogs on diets furnishing known amounts of various fats and on sham diets equivalent to fasting has been analyzed for unsaponifiable matter and nonvolatile, volatile, total, solid, and liquid fatty acids with a view to determining the origin of fecal fat and its relation to fat metabolism.

The data obtained are thought to indicate that the fecal fat does not come directly from unabsorbed fatty material in the food. As evidence in support of this, it is shown that in many cases almost as much fatty material appears in the feces on a fat-free as on a fat-rich diet, that there is a considerable amount of fat in the feces during fasting, and that the fecal fat is different in composition from the food fat. That the fat of the diet has some influence on the fat of the feces, however, is shown by a higher proportion of solid fatty acids excreted on diets high in solid acids and a similar increase in the excretion of liquid fatty acids on diets containing large amounts of liquid fatty acids. The influence of food in general is shown by the greater lipoid excretion on fat-free diets than during fasting.

The most probable origin of fecal fat is thought to be in the blood. Evidence in support of this is the similarity in the lipoids of the blood and feces with regard to the ratios of solid to liquid fatty acids and the melting points of the nonvolatile fatty acids. Two possible explanations of this are advanced: (1) That the lipoid of the feces may be a true excretion of waste material from lipoid metabolism and (2) that it may be a leakage of usable fat due to fat excess. Indirect evidence is given in support of both of these.

Catabolism of odd in comparison with even carbon fatty acids in man, H. LUNDIN (*Jour. Metabolic Research*, 4 (1923), No. 1-2, pp. 151-176, figs. 3).—This and the following paper are contributions from the Physiatrie Institute at Morristown, N. J. In the investigation reported in this paper the author served as subject in an elaborate study of the metabolism of the odd carbon fat intarvin.

An adequate protein, low carbohydrate, and high fat diet was first used until acetone bodies appeared in the urine (about 7 days), when for 100 gm. of the natural fat the same amount of intarvin was substituted. This resulted in 4 days in a decrease in the acetone bodies from 3.3 to 1.5 gm. On returning to the natural fat the acetone bodies increased to 4.7 gm., and on increasing the carbohydrate from 20 to 70 gm. they again disappeared. During the intarvin period the fat absorbed was from 80 to 85 per cent as compared with 95 per cent for the natural fat.

In addition to total acetone bodies, determinations were made of β -hydroxybutyric acid, volatile acids, total organic acid, and individual organic acids. The data thus obtained showed that in the abnormal catabolism of a low carbohydrate-high fat diet when the fat is natural (an even number of carbon atoms), β -hydroxybutyric and acetoacetic acid are formed but no lactic nor pyruvic acid, while on the odd fat diet lactic or pyruvic acid or both are formed, with no β -hydroxybutyric and acetoacetic acid. These results are in accord with the Knoop theory of β -oxidation, and indicate moreover that the acidosis resulting from an improper balance of fat and carbohydrate in normal subjects does not disappear on the substitution of intarvin, but is simply of another kind. This shows that odd-carbon fats, as well as even, require carbohydrate for their complete utilization.

Clinical observations with odd-carbon-atom fat (intarvin), F. S. MODERN (*Jour. Metabolic Research*, 4 (1923), No. 1-2, pp. 177-188).—The conclusions drawn in the metabolic study noted above were substantiated by the clinical results obtained in the use of intarvin in several cases of diabetes. As has been generally reported, extreme difficulty was experienced in taking the

intarvin. Nausea and marked constipation were present in every case and gastrointestinal disturbances in several.

In general the portion of intarvin absorbed appeared to be utilized like natural fat, but from 15 to 25 per cent of the fat was excreted unchanged. A nitrogen-sparing action similar to that of ordinary fat was noted.

Three case reports are given in detail, two of diabetic subjects in whose diet intarvin was substituted for part of the natural fat in connection with insulin treatment, and one of a nondiabetic subject in whom ketosis was induced as in the subject of the previous study and intarvin then substituted for the natural fat.

Practically the only difference between the effect of intarvin and natural fat was the absence of ketosis on the former. The subjective symptoms accompanying ketosis were not relieved, nor was acidosis, as determined by plasma bicarbonate volume, lessened. The intarvin had essentially the same insulin requirement as natural fat.

It is concluded that "for the above reasons an odd-carbon fat is of no possible value in practical diabetic treatment. On account of the interesting theoretical and experimental opportunities opened up, however, it is a valuable contribution to the subject of diabetes and metabolism."

The clinical assaying of insulin and the insulin requirement, R. M. WILDER (*Endocrinology*, 8 (1924), No. 5, pp. 630-638).—In this discussion of the clinical method of assaying insulin by determining its glucose equivalent in diabetic patients of known history, various factors altering the glucose equivalent of insulin are discussed. High protein and high carbohydrate diets, acute diseases in complication, and various infections tend to increase the demand for insulin and starvation to lower it. "The fact that consistent values for the glucose equivalent of insulin have been obtained under standard conditions with patients of different ages and weights is evidence for the assumption that the action of insulin is directly on glucose, and that a definite chemical interaction occurs between insulin and glucose."

The isolation of a hypoglycemia-producing principle from vegetables and the nature of the action of vegetable extracts on the blood sugar of normal rabbits, H. E. DUBIN and H. B. CORBITT (*Jour. Metabolic Research*, 4 (1923), No. 1-2, pp. 89-104).—Evidence is presented that cabbage, celery, lettuce, and spinach contain both hyperglycemia- and hypoglycemia-producing substances, and that red beets and carrots contain the former but not the latter. By a method of fractionation with alcohol, followed by dinitrosalicylic or picric acid, the hypoglycemic substance is precipitated and the hyperglycemic left in the filtrate. From the precipitate the active substance may be obtained as a hydrochloride by decomposing with hydrochloric acid and alcohol and precipitating with ether. The yield is about 0.01 gm. per kilogram of the original substance. The purified substance is said to give positive nitrogen, sulfur, Molisch, and biuret tests and negative Millon and phosphorus tests. When injected into the blood it gives results similar to those produced by insulin. The delayed or prolonged action of glucokin of Collip (*E. S. R.*, 51, p. 66) is considered to be due to the presence of the hyperglycemic substance.

It is suggested that some relationship may exist between insulin and vitamin B, as shown by the similarity in method of preparation and certain properties.

The uric acid problem.—An experimental study on animals and man, including gouty subjects, O. FOLIN, H. BERGLUND, and C. DERICK (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 361-471).—In this extensive investigation of uric acid metabolism the fate of uric acid injected intravenously into various animals was determined by analyses of the blood, urine, and tissues. In the experiments on human subjects, both normal and gouty, uric acid in the form

of lithium urate was injected intravenously, and subsequent analyses were made of the blood and urine.

The general conclusion drawn from the investigation is that uric acid, when injected into the blood stream, is partly taken up by the kidneys and partly destroyed in the blood stream. Differences in different animals and in man are due chiefly to the varying permeability of the kidneys to uric acid. In animals (dogs, cats, rabbits, and goats) the kidneys appear to be very permeable to uric acid and take up a large proportion of it almost immediately. In the dog, with the exception of the Dalmatian hound, the destruction of the uric acid in the circulating blood is extremely rapid at first, about 70 per cent of the amount injected being destroyed in the first 10 minutes and the rest in the next 2 hours. As the destruction in the blood proceeds the portion temporarily stored in the kidney goes back into the blood. In herbivorous animals such as goats and rabbits the destruction of uric acid is only about one-tenth as rapid as in the dog. The blood in all cases loses its power to destroy uric acid when removed from the living animal.

In man the intravenous injection of about 20 mg. per kilogram of uric acid in the form of lithium urate is followed by an increase in the uric acid content of the blood and eventually by the excretion of from 30 to 90 per cent of the amount injected. The high level of uric acid in human blood is thought to indicate a lack of responsiveness of the kidney. High protein diets tend to increase the permeability of the kidneys and thus lower the level of the circulating uric acid and at the same time produce a large excretion of endogenous uric acid.

In gouty subjects the lack of permeability of the kidneys is increased. This has suggested a new point of view for the dietetic treatment of persons with a tendency to gout. "It has long been recognized that such persons should abstain from food which is rich in purines, and it has also been thought advisable to reduce the endogenous production of uric acid by a sparing use of every kind of protein material. But our findings seem to indicate that the best dietetic method for reducing the circulating uric acid should be a purine-free diet containing enough protein to yield 15 to 20 gm. of nitrogen in the urine. The dietetic literature bearing on gout has probably greatly exaggerated the importance of abstaining from all food which contains any purine materials. A small amount of purine products should be of very little consequence provided that the diet is distinctly high in protein."

The experimental findings are thought to furnish proof that the muscles of gouty subjects contain no more uric acid than those of normal subjects, and that only cartilage and connective tissues are permeable to uric acid.

Uric acid excretion, A. E. KOEHLER (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 721-736).—A more limited study than the above is reported of the effects of the intravenous injection of uric acid in the form of lithium urate on its content in the blood and urine of normal subjects, patients with renal insufficiency, and patients with other diseases.

With normal subjects, only about one-half of the injected uric acid was recoverable in the urine, thus pointing to a rapid destruction in the blood. In the case of renal insufficiency, there was a slight retention of uric acid in the blood. The results obtained with patients not having renal disturbances were similar to those obtained with the normal subjects except that the percentage recovery was somewhat lower and individual variations somewhat greater.

The photoactivity of substances curative of rickets and the photolysis of the oxy-products of ultraviolet radiation, I. N. KUGELMASS and I. McQUARRIE (*Science*, 60 (1924), No. 1551, pp. 272-274).—The experiments reported

in this paper were planned to determine if possible the relationship between radiant energy and the various substances curative for rickets.

Substances known to be curative and noncurative for rickets were tested for the emission of ultraviolet radiation in the natural state, after having been made alkaline with 10 per cent potassium hydroxide and oxidized by treating with a current of pure oxygen, and after having been reduced with ammonium ferrotartrate. The method consisted in placing the substances to be tested in beakers covered with specially prepared photographic plate holders, containing in one case quartz and in the other glass screens covered with ultraviolet sensitive films. The whole apparatus was placed within a double light-proof container and allowed to stand for 24 hours, after which the plates were developed in a suitable medium.

Substances curative for rickets upon oxidization blackened the sensitive film through quartz but not through glass screens. The same substances untreated produced the same effect, though not to so marked an extent. The noncurative substances and the reduced substances, both curative and noncurative, did not blacken the sensitive film through either quartz or glass.

It is concluded that the curative substances upon oxidization give off ultraviolet rays similar to those emitted by the quartz mercury vapor lamp.

"The experiments recorded may be applicable to physiologic phenomena in general. Not only do they suggest the mechanism common to all rickets-healing processes and imply a method to measure the therapeutic potency of the curative agents, but they also disclose the fact that solar energy exerts a hitherto neglected function in the physiology of higher organisms as well as in plants."

The photo-activity of substances curative of rickets—a remarkable discovery (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 15, pp. 1169-1171).—An editorial discussion of the above paper and a previous paper by Park et al. (*E. S. R.*, 50, p. 262).

ANIMAL PRODUCTION

Seasonal changes in organ weights and their relation to meteorological conditions, W. H. BROWN, L. PEARCE, and C. M. VAN ALLEN (*Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 7, pp. 373-375).—In a study of the variations between the ratio of the weights of various organs and the body weights in rabbits, conducted at the Rockefeller Institute for Medical Research, two groups of rabbits were killed each month. The results of a study of the relationship of this ratio to environmental conditions indicated that "all the organs examined were found to undergo rhythmic changes in weight per unit of net body weight which conformed in general to the progression of the seasons."

The changes in the weights of the heart and kidneys amounted to about 20 per cent, while the liver exceeded 40 per cent, and the endocrine glands, thymus, spleen, and lymph nodes in some cases amounted to from 50 to 100 per cent. The changes in the weights of the majority of the organs appeared to be related to the actual amount of sunshine which occurred at the different seasons, but others appeared to be more closely related to temperature or humidity.

The effect of acute scurvy on the subsequent nutrition and growth of guinea pigs, W. E. ANDERSON and A. H. SMITH (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 181-191, figs. 4).—In a study at the laboratory of physiological chemistry at Yale University of the subsequent effect of acute scurvy on nutrition and growth, 9 pairs of guinea pigs were used. All the pigs were supplied with a diet lacking only in vitamin C and consisting largely of soy bean gruel

flour and maysoya. In addition 20 gm. of fresh raw cabbage were fed daily to one of the guinea pigs of each pair (control), while the other (experimental) animal received an equivalent amount of cooked dried cabbage. The amount of feed furnished daily to the control animals was limited by the amount consumed by the experimental animals on the preceding day. Scurvy, as indicated by sensitiveness of the wrists, developed in the experimental animals in from 10 to 18 days. Three days after the development of the scorbutic symptoms 20 gm. of fresh raw cabbage replaced the dried cabbage in the ration.

The results of the experiment, which in 5 cases lasted from 51 to 61 days and in 4 cases extended over a period of from 103 to 110 days, indicated that the food intake decreased with the onset of scurvy, which was also accompanied by a decrease in the growth rate as compared with the controls, though equal amounts of feed were consumed. After the feeding of raw cabbage to the experimental animals was begun, the consumption by these animals of the soy bean ration was from 1.8 to 26.6 per cent greater than that of the controls, and a rate of growth equal to the controls was resumed.

It is thus concluded that scorbutic animals suffer a decrease in body weight greater than that simply due to inanition. As indicated by the conditions of the animals, growth rate, and X-ray pictures, the curative measures used removed the pathological evidences of acute scurvy, though greater amounts of food were consumed per unit of gain than by the controls, indicating that normal recovery was not entirely complete.

Phosphorus in the live stock industry, A. THEILER, H. H. GREEN, and P. J. DU TOIT (*Union So. Africa Dept. Agr. Jour.*, 8 (1924), No. 5, pp. 460-504, figs. 29).—The results of experiments conducted by the Department of Agriculture, Union of South Africa, which indicate that phosphorus is a limiting factor in the growth of young stock, the milk production of cows, the rate of gains made by fattening steers, and the economy of feed utilization by the various types of animals, are given. The low phosphorus content of the soil accounts for a very low phosphorus content of the range plants and the frequent occurrence of osteophagia in range cattle. Bone meal feeding is recommended. Pot experiments with range vegetation indicate that the phosphorus deficiency of the soil and lack of rainfall are the two main factors limiting the carrying capacity of the ranges.

Grassland and the grazing animal, R. G. STAPLEDON, T. W. FAGAN, and R. D. WILLIAMS (*Welsh Plant Breeding Sta., Aberystwyth, [Bul.], Ser. H, No. 3 (1920-1923), pp. 159-168*).—This is mainly a discussion of various methods of handling pastures, dealing with the advisability of pasturing after-math, the injuries from overstocking, desirability of rotating pastures, etc.

Feed inspection report, 1923, J. O. HALVERSON and L. M. NIXON (*N. C. Dept. Agr. Bul.*, 1924, June, pp. 79).—In addition to the usual report (E. S. R., 50, p. 169) of the guaranteed and found contents of protein, fat, and fiber in the samples of feeding stuffs officially analyzed during 1923, two papers are presented.

Onion milk investigation, S. Combs and J. O. Halverson.—Three cows received onion tops in amounts of from 2 to 2.5 lbs. daily, and the milk was tested for onion flavor with and without the feeding of "Mrs. Lea's Milk and Butter Purifier" to the cows. When this substance was not fed an onion taste was evident in 32 of the 33 samples taken, but only in 43 of 106 samples collected from the cows when they were receiving the milk and butter purifier. The ingredients of the purifier were found to consist of common salt, charcoal, sodium bicarbonate, Epsom salts, and sugar.

The calcium requirement of animals in relation to the calcium content of feeds, J. O. Halverson and L. M. Nixon.—The calcium needs of livestock and the calcium contents of feeds are briefly discussed.

Commercial feeding stuffs, J. L. HILLS, C. H. JONES, and G. F. ANDERSON (*Vermont Sta. Bul.* 242 (1924), pp. 3-32).—The usual report of the official inspection of feeding stuffs during the spring of 1924 (*E. S. R.*, 52, p. 167).

Waters suitable for live stock.—**Analyses and experiences in New South Wales**, A. A. RAMSAY (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 5, pp. 339-342).—The following conclusions as to the suitability of water for livestock were based on analyses of samples of water sent to the New South Wales Department of Agriculture:

"(1) Horses will thrive on water containing 400 grains common salt and 550 grains total solids per gallon, and provided they are not worked may be sustained on water containing up to 638 grains salt and 950 grains total solids. Water containing as much as 798 grains salt and 1,022 grains total solids has been used for a period of three months without ill effects.

"(2) Cattle will thrive on water containing 800 grains common salt and 1,000 grains total solids, but when the concentration reaches 970 grains salt and 1,300 grains total solids they are injuriously affected.

"(3) Sheep will thrive on water containing 800 grains common salt and 1,000 grains total solids, and will do well even up to 1,197 grains salt and 1,350 grains total solids. When the concentration reaches 1,277 grains common salt and 1,868 grains total solids the sheep are injuriously affected."

Beef cattle investigations on the farm—Kansas Experiment Station, 1923-24, C. W. McCAMPBELL (*Cattleman*, 11 (1924), No. 1, pp. 59-65).—The results of comparative tests of adding varying amounts of cottonseed meal to a basal ration of corn, alfalfa, and cane silage for baby beef and of different methods of feeding beef calves are reported from the Kansas Experiment Station. The experiments dealing with the addition of different amounts of cottonseed meal to the ration were conducted with 4 lots averaging about 415 lbs. per steer. The basal ration fed to all lots and without additions to lot 1 consisted of a full feed of cane silage and corn plus 2 lbs. of alfalfa hay per head daily. Lots 2 and 3 received additional supplements of 1 and 2 lbs., respectively, of cottonseed meal per head daily, while lot 4 received 1 lb. of linseed oil meal.

The average daily gains made during the 165-day test by the 4 lots in their respective order were 1.88, 2.12, 2.10, and 2.10 lbs. The check lot receiving only the basal ration required 476 lbs. of corn, 107 lbs. of alfalfa hay, and 574 lbs. of silage per 100 lbs. of gain. The lot receiving additions of 1 lb. of cottonseed meal per head daily required 422 lbs. of corn, 94 lbs. of alfalfa, 509 lbs. of silage, and 42 lbs. of cottonseed meal per 100 lbs. of gain. With the supplement of 2 lbs. of cottonseed meal per head daily, 413 lbs. of corn, 95 lbs. of alfalfa, 514 lbs. of silage, and 80 lbs. of cottonseed meal were required per 100 lbs. of gain. The feed requirements per 100 lbs. of gain of the lot receiving linseed meal were 430 lbs. of corn, 95 lbs. of alfalfa, 514 lbs. of silage, and 43 lbs. of linseed meal. The estimated values of the calves per 100 lbs. at the conclusion of the test as an indication of their finish were \$8, \$8.25, \$8.35, and \$8.50, respectively. It was concluded that the addition of 1 lb. of cottonseed meal or linseed meal to the basal ration increased the rate of gain, finish, and profits as compared with the control lot.

In comparing various methods of wintering calves, it was found that full feeding calves on corn, cottonseed meal, alfalfa hay, and silage from weaning time in the fall until late spring or early summer was more profitable than

roughing the calves through the winter on corn silage, with limited amounts of alfalfa hay or cottonseed cake, followed by subsequent full feeding in dry lot or on pasture and marketing in the fall. In regard to the two latter methods of feeding, calves on pasture were found to require less feed per unit of gain and sold for a better price and thus at a greater profit than calves roughed through the winter and finished in dry lot.

Beef-cattle production in the range area, V. V. PARR (*U. S. Dept. Agr., Farmers' Bul.* 1395 (1925), pp. II+44, figs. 20).—This deals with the methods of management, feeding, and breeding of beef cattle in the range area, which is considered as that portion of the United States west of the one-hundredth meridian.

Dual-purpose cattle merits demonstrated in Minnesota, R. E. HODGSON (*Breeder's Gaz.*, 86 (1924), No. 14, p. 307, fig. 1).—This consists of a brief report of the milk records made by a herd of milking Shorthorns established at the Southeast Demonstration Farm and Substation near Waseca, Minn., in 1913.

The average annual production per cow from 1919 to 1923 varied from 6,169 to 6,938, lbs. of milk. The fat yields ranged from 210 to 268 lbs. per year.

The results of an experiment in feeding steers from this herd averaging 555 lbs. at 13 months of age are reported during a 180-day feeding test. The average daily gains made were 2.42 lbs., with a feed requirement per 100 lbs. of gain as follows: 292.4 lbs. of ground corn, 119.4 lbs. of ground oats, 28.9 lbs. of linseed meal, 800 lbs. of corn silage, and 194.8 lbs. of alfalfa hay. The author believes that it is thus demonstrated that cows yielding a satisfactory milk production may also produce calves making good beef.

Lamb-raising trials, season 1923, E. A. ELLIOTT (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 5, pp. 331-335).—Another year's results are reported of the experiments conducted at the Cowra and Bathurst Experiment Farms, New South Wales, previously noted (*E. S. R.*, 50, p. 271). In the 1923 experiments at Cowra, lots of 120 Border Leicester×Merino and Lincoln×Merino ewes each were mated with 2 Dorset Horn and 2 Ryeland rams, respectively. The Dorset rams produced 98 and the Ryeland rams 115 lambs that were marked. There were 94 ewes in each of two lots similarly mated at the Bathurst farm. Eighty-six lambs were marked from the 2 Dorset Horn rams, while only 70 offspring of the Ryeland rams were marked. In the experiments at both farms, it was found that the lambs from the Dorset crosses were taller and more leggy, while the Ryeland cross lambs were more compact and solid and therefore more attractive.

Lamb feeding experiments at the Irrigation Branch Experiment Station, H. HACKEDORN, R. P. BEAN, and J. SOTOLA (*Washington Col. Sta. Bul.* 185 (1924), pp. 42, figs. 4).—The combined results of three years' experiments (1922-1924) in fattening lambs are reported, the first two years' results having been noted (*E. S. R.*, 48, p. 269; 51, p. 172). As in the earlier experiments, the first and third cuttings of alfalfa hay proved superior to the second cutting, while well-cured sweet clover compared favorably with alfalfa hay. The feeding of corn silage proved advantageous in the three years' trials as compared with the use of hay as the sole roughage.

Sheep shearing, J. H. KRUGER (*Union So. Africa Dept. Agr. Jour.*, 9 (1924), No. 1, pp. 10-30, figs. 17).—This includes a discussion of the methods of shearing sheep, including directions for baling the fleece and other related information.

Methods of investigating the physical properties of wool (trans. title), E. TÄNZER (*Deut. Landw. Tierzucht*, 28 (1924), No. 25, pp. 353-358).—This is mainly a discussion of the results of various investigations of the relations

of fineness of wool fibers to their strength, stretching qualities, and other physical properties.

[Hog feeding experiments by the Canadian Department of Agriculture], G. B. ROTHWELL (*Canada Expt. Farms, Anim. Husb. Div. Interim Rpt., 1922, pp. 43-63, figs. 10*).—In one experiment skim milk was found superior to buttermilk or water as a supplement to the ration of sows while suckling pigs. In another experiment fattening pigs made greater gains on pasture than others confined in a piggery, but the former lot averaged 50.7 lbs. at the start as compared with 35.7 lbs by the second lot. The more economical gains were made by the confined pigs. The addition of a mineral mixture to the ration of fattening pigs slightly increased the rate of gain, but also increased the feed consumption per unit of gain. The addition of molasses to the ration increased the gains, but also increased the costs of gain. Molasses-fed hogs showed more gloss to the hair and higher finish.

In a comparison of 25-lb. Berkshire and Yorkshire pigs on self-feeders, the pigs of the former breed made greater daily gains but required slightly larger amounts of feed, therefore the Yorkshires produced the more economical gains. In a comparison of the rate and economy of gains made by Berkshires, Yorkshires, and crossbred Berkshire-Yorkshire pigs, it was found that the latter pigs gained more rapidly than either of the purebred lots and consumed less feed than the Berkshires. The Yorkshires made the slowest but the most economical gains. In experiments with the crossbreds, oat flour substituted for ground oats in the ration produced more rapid gains, but the costs of gain were greater. Both Berkshires and crossbreds were inferior to Yorkshires for the production of Wiltshire sides, the former particularly because of lack of length and uniformity of fleshing, while the latter lacked uniformity in length.

The results of several comparisons of hullless oats and ground oats when fed with shorts, middlings, flax, and tankage were somewhat contradictory as to the superiority of each.

A comparison of self-feeding and hand-feeding of hogs indicated that gains were made more rapidly but less economically with a self-feeder. The quality of the carcass from a bacon standpoint was not so good as that produced by hand-feeding. One lot of 4 sows receiving an average ration of 7 lbs. of grain and 1 lb. of beet pulp farrowed an average of 9 pigs averaging 2.83 lbs. each at birth, while another lot of 5 sows receiving daily rations of 5 lbs. of grain and 5 lbs. of pulp mangels farrowed an average of 12 pigs per sow, having birth weights averaging 2.91 lbs. each. One lot of pigs having access to water at all times made greater and more economical gains than another lot receiving the same ration (grain mixture) and buttermilk.

In a study of the desirability of Berkshire and Yorkshire carcasses for bacon production, it was found that Yorkshires more closely met the requirements of the packers. A select Berkshire carcass was a little heavier than desired and not quite so long as the Yorkshire. A heavy Berkshire carcass was too thick and heavy.

“Pineapple bran” mixture versus barley and tankage for hogs, L. A. HENKE (*Hawaii Univ. Quart. Bul., 3 (1924), No. 1, pp. 27-32*).—In hog feeding experiments at the University of Hawaii, the gains made by pigs averaging 71 lbs. while fattening on barley and tankage in separate self-feeders were compared with the gains made when self-fed a mixture of pineapple bran, wheat middlings, coconut meal, and tankage, 5:3:1:1. The fattening period, which lasted from November 10 to January 26, was divided into four sub-periods, and the rations were reversed for each lot during each successive sub-

period. The results showed that while fattening on the pineapple bran mixture average daily gains of 0.98 lb. per pig were made, as compared with 1.06 lbs. on the barley and tankage ration. Per pound of gain, 4.53 lbs. of concentrates were consumed on the former ration as compared with 5.19 lbs. on the latter. The calculated costs of feed per pound of gain on the two rations were 9.27 and 10.59 cts., respectively. Additional minerals were available to both lots. It is stated that the pigs receiving the barley and tankage ration appeared the more thrifty.

The same pigs used in these experiments received free access to a number of feeds provided in separate self-feeders from the time of weaning on October 1 until the beginning of the experiment on November 10. The rations as balanced by them consisted of the following proportions of the different feeds: Wheat middlings 26 per cent, cracked corn 28, rolled oats 7, tankage 17, rolled barley 16, and pineapple bran 6 per cent.

Pig breeders' annual, 1923 (*London: Natl. Pig Breeders' Assoc., 1923, pp. 67+I, II, figs. 17*).—This is the usual pig breeders' annual for 1923 (E. S. R., 48, p. 171) containing the following articles dealing mainly with the practical application in swine production of the results of scientific investigations: Some Digressions upon Breeding, by H. G. Robinson; Differences in Quality of Pig Foods, by W. M. Tod; The Vital Importance of Developing the Pig Industry, by L. C. Paget; Vomiting in Pigs, by H. Leeney; Notes on Feeding Stuffs for Pigs, by C. Crowther; Dry Feeding of Pigs, by W. A. Stewart; The Position of the Pig Industry, by J. Long; and The Improvement of Live Stock, by F. N. Webb, as well as other information and statistics of interest to the swine producer.

Pig breeders' annual, 1924 (*London: Natl. Pig Breeders' Assoc., 1924, pp. 17-134, figs. 34*).—The following articles are included in the pig breeders' annual for 1924: Records of Production and Their Use in Breeding, by H. R. Davidson; Animal Nutrition, by E. T. Halnan; Genetics and the Pig Breeder, by F. A. E. Crew; The Future Possibilities of Breed Society Work, by H. G. Robinson; The Pedigree versus the "Scrub" Pig for the Butcher; "Wiltshire" Bacon, by R. P. Redman; The Use of Separated Milk for Pig Feeding, by W. M. Tod; Rickets in Pigs, by H. Leeney; Bacon-pigs: The Midland Curers' Requirements, by A. E. Marsh; On Protein and Proteins as Affecting Pig Feeding, by F. W. Jackson; The Common Diseases of Swine, by G. H. Conn; Some Defects of the Open Air System, by C. F. Chance; The Home Slaughtering and Marketing of Pigs, by V. C. Fishwick and V. R. S. Vickers; Simple Facts Relating to Pig Rations and Feeding, by V. C. Fishwick; The Value of Pedigree Stock for Commercial Purposes, by H. Henshaw; Sexual Abnormalities in Pigs, by J. R. Baker; and Bacon Factories in England and Scotland.

The economy and effect of corn in the winter feeding of horses, G. B. ROTHWELL (*Canada Expt. Farms, Anim. Husb. Div. Interim Rpt., 1922, pp. 39, 40*).—Fourteen work horses were used in comparing a ration of oats and bran, 13:2, fed with timothy and alsike hay, with a ration of oats, corn, and bran, 5:8:2, fed with similar hay. The experiment lasted 12 weeks, the 2 horses of each team always being on different rations. The results showed that the horses gained on both rations, but the one including corn was less expensive, though the gains were slightly less.

The police dog, D. BROCKWELL (*New York: G. Howard Watt, 1924, pp. 190, pls. 10, figs. 16*).—The origin, characteristics, breeding, care, diseases, training, and uses of police dogs are in turn discussed. An introduction is included by G. G. Anderson and illustrations by R. W. Tauskey.

The effect of feeding thyroid on the plumage of the fowl, L. J. COLE and D. H. REID (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 6, pp. 285-287, pl. 1).—The results are briefly reported of a study of the effect of thyroid feeding on the characteristics of new feathers produced by Brown Leghorn cockerels, which was conducted at the Wisconsin Experiment Station from February 9 to May 2, 1923.

One lot of 4 birds received every other day at first and later daily 400 mg. of desiccated thyroid containing 0.8 mg. of iodine. Other birds received a like amount of iodine either dissolved in alcohol or in the form of potassium iodide, while others not treated were used as controls. Feathers were pulled from the cape and wing bow on February 20 and later from the saddle and sickle of each bird, and the new developing feathers carefully watched. The replacement of the feathers was apparently more rapid in the birds receiving the thyroid, and these feathers were strikingly modified. There was much variability, but it was evident that a reduction in the red pigment occurred which tended toward stippling if any red were present. The broad rounded ends of these feathers and lack of barbs also resembled female feathers. The replaced feathers of the control birds showed no such change. The action of the thyroid was supposed to be due to a direct action on the metabolism of the feather germ.

Investigation of body form and egg production [trans. title], WEINMÜLLER (*Deut. Landw. Tierzucht*, 28 (1924), No. 23, pp. 327-330, figs. 8).—The relation between body measurements and annual egg production per kilogram of live weight of the fowls of several breeds has been studied at the Technical High School at Munich. It was found that certain of the body characters, as determined by correlation coefficients, were fairly good indicators of productive capacity, but that none were as good as actual egg records.

Egg weight in relation to production.—Part II, **The nature and causes of changes in egg weight in relation to annual production in pullets**, M. A. JULL (*Poultry Sci.*, 3 (1924), No. 5, pp. 153-167, 170-172, figs. 2).—This is the second study in the series previously noted (*E. S. R.*, 51, p. 674), and consists of a statistical treatment of the weights of the eggs, age in days at commencing laying, maximum body weight, and annual egg production of 40 Barred Plymouth Rock pullets. Coefficients of correlation were calculated between the averages for the different determinations, and Path's coefficients were calculated between the different factors and egg weight. The author summarizes the paper dealing with the effect of the various factors on egg weight as follows:

"Age in days that pullets commence laying and rate of production seem to be due primarily to genetic factors. Since the earlier that laying commences the greater is the production, the total production for the pullet year is due to the hereditary constitution of the individual. Also, since the earlier that laying commences the lower is the mean weight of the total production, it would appear that the size of egg laid is also due to the hereditary constitution of the individual. On the other hand, mean egg weight is more probably due primarily to physiological factors, since it has been shown that antecedent production affects rate of increase both in egg weight and body weight."

Culling for efficient egg production, W. H. RICE (*Md. Univ. [Agr.] Ext. Bul.* 35 (1924), pp. 20, figs. 11).—Popular directions for culling poultry for egg production are given.

The effect of cod liver oil in various amounts and forms on the growth of young chickens, L. C. DUNN (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 129-136, fig. 1).—This is a more detailed report of the second experiment pre-

viously noted from Connecticut Storrs Station Bulletin 116 (E. S. R., 51, p. 378).

Experiments in incubation, W. C. RUGG and W. O. FEDERICK (*Jour. Dept. Agr. Victoria*, 22 (1924), No. 8, pp. 511, 512).—In a study of the methods of incubating hen's eggs artificially at the Werribee State Research Farm, it was found that the hatch was slightly increased by placing a moisture tray in the incubator. The hatch was only about one-half as good when the eggs were turned on the fifth and fourteenth days only, i. e., at the time of testing for fertility.

The present outlook for the poultryman, G. W. HERVEY and C. S. PLATT (*New Jersey Stat. Hints to Poultrymen*, 13 (1925), No. 5, pp. 4, figs. 3).—A popular discussion of the relation of feed prices to egg production, with comparisons for the preceding years.

Muskrat farming, [J. L. EDWARDS] (*Utica, N. Y.: Fur Farms Pub. Co.*, 1924, pp. 56, figs. 13).—This consists of a popular discussion of muskrat farming, including directions for the trapping of wild breeding stock.

DAIRY FARMING—DAIRYING

Report of the proceedings of the forty-third annual convention of the Connecticut Dairymen's Association, held at Unity Hall, Hartford, Conn., January 23-24, 1924 (*Conn. Dairymen's Assoc. Rpt. Proc.*, 43 (1924), pp. 138).—In addition to the routine proceedings of this association, the following papers were presented: Milk Advertising in Connecticut, by D. Buckley; Feeding Cows on Official Test, by E. J. Perry; Clean Milk, Its Relation to Profitable Dairying, by R. C. Fisher; Summer Feeding and Forage Crops, by H. E. Cook; The Mating of Sexually Sound Animals as the First Principle in Successful Reproduction, by W. L. Williams; Better Bulls for Connecticut, by A. R. Merrill; The Importance of the Human Equation in Dairying, by H. E. Cook; The Future Outlook in Dairying, by E. J. Perry; An Outline for the Control of Sterility and Abortion, by W. L. Williams; The Feeding of Calves, by A. R. Merrill; and The Quest for the Fountain of Health, by M. E. Dallinger.

On the protein requirement of milk production, J. A. FRIES, W. W. BRA-MAN, and M. KRISS (*Jour. Dairy Sci.*, 7 (1924), No. 1, pp. 11-23).—This is a more detailed account of an investigation conducted from February 28 to May 1, 1919, at the Pennsylvania Institute of Animal Nutrition than was previously noted (E. S. R., 52, p. 274). The study deals with the minimum protein requirements of dairy cattle for milk production. Two mature Jersey cows were used as the experimental animals. The rations fed were made up of alfalfa hay, corn meal, linseed oil meal, peanut meal, oat straw, and corn-starch, which were mixed in proper proportions to supply the specified amounts of protein, the total of which in each ration was derived 35 per cent from the alfalfa hay, 25 per cent from corn meal, 20 per cent from linseed oil meal, and 20 per cent from peanut meal.

The experiment was divided into five test periods of 7 days each, with transition periods of from 2 to 5 days. After allowing 0.5 lb. of digestible true protein per 1,000 lbs. of live weight for maintenance, the following amounts of digestible true protein in relation to the protein in the milk produced in the preceding period were fed in the respective periods for one cow 1.6, 1.3, 1.027, 1.28, and 1.869 times the milk protein and for the other cow 1.6, 1.3, 1.028, 0.966, and 2.054.

The results of the experiments are tabulated in detail, showing the daily nitrogen balances, live weights of the cows, milk and fat production, and the percentages synthesized of the total nitrogen and that available for milk pro-

duction, as well as other related data. The milk production in the different periods was apparently very little affected by changes in the amount of protein supplied, indicating "that the milk-producing cow adheres to her natural rate of milk production with remarkable persistence in spite of extensive change in the nitrogen intake." The decrease in the nitrogen intake was almost entirely made up in those periods of low intake by a decreased amount of nitrogen in the excreta.

The authors state that it appears from the experiment that the smallest amount of crude protein, fed, i. e., 1.11 and 1.17 times the milk protein, was the most satisfactory for economical production, as there was no significant change in the live weights of the animals and the efficiency of the protein utilization was high, 85.5 and 97.3 per cent. It is of interest to note that the coefficient of digestibility of the nitrogen was apparently decreased as the consumption of nitrogen decreased, and again increased with increases in the nitrogen consumption. This is due to metabolic protein being more nearly a body constant than a variable related directly to the feed.

Feeding cocoa meal to dairy cows, H. B. ELLENBERGER and J. A. NEWLANDER (*Vermont Sta. Bul. 243 (1924), pp. 3-20, figs. 2*).—The results of five experiments in which cocoa meal was fed to dairy cows are reported. Six cows were fed in each of the first two experiments by the double reversal method, the comparative rations consisting of a grain mixture containing 18.2 per cent of protein and a similar ration of equal protein content containing 10 per cent of cocoa meal. The feeding periods were 4 weeks in duration, with intervening transition periods of 1 week. In the third experiment the same basal ration was similarly compared with one containing 20 per cent of cocoa meal, using 8 cows for the trial.

The results of the three experiments showed that there was a reduction in milk yield varying from 5 per cent with the 10 per cent cocoa meal ration to 13 per cent for the 20 per cent cocoa meal ration. The decrease in milk flow was accompanied by an increase in the solids content of the milk, amounting to 15.41 per cent in the fat when the grain consisted of 20 per cent of cocoa meal.

To study the effect of temporary feeds of cocoa meal on the butterfat yields in the 2-day advanced registry tests, 28 cows were divided into four groups, one of which received a basal ration, while the others received 2, 4, and 6 feeds, respectively, of 20 per cent cocoa meal in the grain mixture. The milk yields decreased, and the fat percentages increased for 2 days subsequent to the cocoa feeding. Similar results were obtained in another trial in which only 1 and 2 feeds of the cocoa meal were given.

To test the effect of cocoa meal on the condition of the animal, a small Jersey heifer was fed without bad effects for 24 weeks on a ration containing as much as 40 per cent of cocoa meal. The milk tested 6.69 per cent butterfat during the last 3 weeks of the trial.

Optimum root crop ration as shown by feeding experiments with dairy cows [trans. title], N. HANSSON (*Meddel. Centralanst. Försöksv. Jordbruksomrâdet [Sweden], No. 268 (1924), pp. 34, figs. 3*).—In studying the replacement values of oats and roots for milk production, four rations were used for comparison: 5.4 kg. of ground oats, 3.6 of ground oats and 15 of roots, 1.8 of ground oats and 30 of roots, and 45 kg. of roots. In the replacement it was calculated that 1.2 kg. of oats could be replaced by 1.1 kg. of dry matter in the roots.

The results of the experiment indicated that as the amount of roots in the ration was increased, especially above 30 kg., the efficiency of utilization decreased. When medium sized root rations were exchanged for oats, one food

unit of oats (1.2 kg.) and 1.1 kg. of dry matter in the roots were practically equal in nutritive value. Decreases in milk production and losses in live weight accompanied the feeding of from 40 to 45 kg. of roots to the animals daily.

The bulletin is abstracted in English.

[Carrying capacity of irrigated pastures], D. HANSEN (*Montana Sta. Bul.* 166 (1924), pp. 12-26, figs. 3).—The author reports the results of studies of the carrying capacity of various pastures with dairy cattle, conducted from 1918 to 1923. Data accumulated during the first four years' work have been previously noted (*E. S. R.*, 49, p. 875). In the test from 1921 to 1923 the carrying capacity of the pastures was increased an average of 14 per cent by top-dressing each year with 10 loads of manure per acre.

Studies in the growth and nutrition of dairy calves.—IX, X, A. C. McCANDLISH (*Jour. Dairy Sci.*, 7 (1924), Nos. 1, pp. 94-106, figs. 4; 2, pp. 160-162).—This continues the series (*E. S. R.*, 51, p. 378).

IX. *The addition of tomatoes to a milk ration.*—Two calves were used in studying the factors responsible for the deficiency of milk as the sole diet. One calf, which was fed milk alone, died at 180 days of age. The other calf was fed whole milk only until the end of 7 months, after which it received 1 lb. 3 oz. of canned tomatoes daily in addition. The tomatoes were replaced by alfalfa hay at the end of 12 months, and the calf was slaughtered at 15 months of age. The calf dying at 180 days was below normal in weight and measurements, while the other calf had a tendency to be above normal in live weight, but the body measurements were not increasing at a normal rate until alfalfa hay was fed. The latter calf chewed the pen during the fifth month of the experiment and became stiff in the joints in the seventh month. These conditions were temporarily relieved by the tomato juice, and the eyes, which had previously become watery and dull, became normal. Within 2 months, however, the calf again returned to its former condition, but by the addition of alfalfa hay to the ration the calf was put in good shape.

The results of this and preceding studies of this series indicate that milk is not satisfactory as the sole feed of calves for any considerable time. The animals could not consume enough milk to provide for their requirements of digestible nutrients. The necessity of supplying additional dry matter, bulk, and minerals in the milk ration is pointed out.

X. *Self-feeding a grain mixture to young calves.*—In continuing the experiments on the use of self-feeders for raising dairy calves (*E. S. R.*, 51, p. 378), four calves averaging 16 days of age were started on whole milk hand-fed during two monthly periods, followed by the gradual substitution of skim milk for the whole milk during the third, fourth, and fifth months, with skim milk only furnished during the sixth month. The grain mixture of cracked corn, ground oats, wheat bran, and old process linseed oil meal (5:2:2:1) was kept before the calves at all times, as well as alfalfa hay and salt. An average of 1,062 lbs. of whole milk, 1,153 lbs. of skim milk, 214 lbs. of alfalfa hay, and 604 lbs. of the grain mixture were consumed per calf during the six-month period.

The average weight at the start of the test was 59 lbs. and at the end of the trial 346 lbs., or a gain of 491 per cent. Gains in height, depth, and width of 37, 56, and 77 per cent, respectively, were also made. The gains were all better than those made by the normally fed heifers in study 3 of this series (*E. S. R.*, 47, p. 781), and the calculated costs of the self-fed mixture were also lower.

A note on the similarities between the curves of growth and of regeneration, S. BRODY (*Jour. Gen. Physiol.*, 6 (1924), No. 6, pp. 629-633, fig. 1).—

It is shown that the curves of growth in the dairy cow and regeneration in the tail of the tadpole follow the same general course and can be represented by the same exponential equation. Both curves have the common peculiarity of a slow rate in the early stages of growth or regeneration. The conditions responsible for the lag in the early rate of growth are discussed.

The change of form with age in the dairy cow, S. BRODY and A. C. RAGSDALE (*Missouri Sta. Research Bul.* 67 (1924), pp. 3-48, figs. 40).—The changes in form of the dairy cow during growth are shown by photographs, graphs, and by superimposing outlines of animals of one age upon those of another. The work is based on 21 linear measurements taken at monthly intervals during the first 60 months of extra-uterine life. The data are based on Jerseys, Holsteins, and Ayrshires.

Interpretation of dairy pedigrees, J. W. GOWEN (*Maine Sta. Bul.* 318 (1924), pp. 53-80, figs. 5).—A popular account of what may be observed from pedigrees, based mainly on the statistical analyses of milk records previously noted from various sources.

The effect of the sugar content in the manufacture of commercial ice cream, W. H. E. REID (*Missouri Sta. Research Bul.* 69 (1924), pp. 3-15, figs. 5).—An investigation of the various properties of ice cream made with sugar contents varying from 8 to 16 per cent has indicated that the higher contents of this ingredient reduce the hardness, time required for melting, and score of the finished product, and also the overrun when above 12 per cent. Increases in the percentage of sugar caused relative increases in the density of the mix, the time required for freezing, and the weight of the ice cream. The hardness was determined by finding how far a needle with a definite force would penetrate a brick, while standing up qualities were tested in a temperature of 86° F.

VETERINARY MEDICINE

Normal immunity reactions of the cow and the calf with reference to antibody transmission in the colostrum, J. B. NELSON (*Missouri Sta. Research Bul.* 68 (1924), pp. 3-30).—Following an extensive review of the literature on antibody transmission in the colostrum of the cow, a series of experiments is reported in which an attempt was made to determine the cause of the increased resistance of the suckled calf to *Bacillus coli* invasion.

In the first, two cows were immunized with horse blood cells late in the gestation period, and at parturition the blood of the calf and of the dam and the colostrum were tested for the presence of hemolytic amboceptor. The blood of the calf and the colostrum were also tested at varying periods thereafter. The blood and colostrum of one of the cows showed a higher titer of anti-horse hemolysin than that of the other, but in both cases the titer of the colostrum was as high as that of the blood. No hemolysins were present in the blood of the calf until after nursing. The maximum concentration of antibodies occurred 24 hours after nursing and was followed by a gradual decline. The concentration of antibodies in the colostrum declined most rapidly during the first 24 hours and then more slowly, until at the end of 2 weeks it had practically disappeared.

A study was next made of the bacteriolytic action of normal blood serum of the cow for *B. coli*, followed by a similar study of the blood of the calf before nursing and after receiving colostrum or milk. The fresh normal blood serum of the cow inhibited to a marked extent the growth of *B. coli* but not of *Staphylococcus aureus* or *B. subtilis*. The inhibition was accompanied by lysis of the bacilli after preliminary agglutination. Serum from which complement

had been removed by heating, deterioration, or specific fixation did not inhibit the growth of *B. coli*. The blood serum of the calf before nursing showed slight inhibiting action toward *B. coli*. A small amount of complement was present in the serum and this was almost completely removed by the addition of *B. coli*. After nursing the complement titer was markedly increased, and this was accompanied by increased bacteriolytic action toward *B. coli*. Similar changes took place when milk was fed instead of colostrum, indicating that the increased bacteriolytic action of calf serum is not due to transmission of antibodies through the colostrum.

Finally a study was made of the agglutinating action toward *B. coli* of the serum of the cow and the calf and of colostrum. Agglutinins were found to be present regularly in the blood serum of the cow and in even larger amounts in the colostrum. No agglutinins could be demonstrated in the blood serum of the calf before suckling nor after being fed ordinary milk, but appeared shortly after the ingestion of colostrum, indicating direct absorption.

It is concluded that the newborn calf possesses some degree of protection against invasion by *B. coli* through the bacteriolytic action of its blood serum, and that this protection is increased to a marked extent by the agglutinins which are passively transmitted to the serum by means of colostrum.

Tissue resistance and the cause of permanent acquired immunity, S. NUKADA and T. MATSUZAKI (*Jour. Expt. Med.*, 40 (1924), No. 5, pp. 661-669).—In an attempt to explain the nature of the permanent immunity acquired after a single attack of certain infectious diseases such as smallpox, typhoid fever, etc., experiments were conducted on the freshly isolated hearts of rabbits. The first test consisted in comparing the resistance of the hearts of typhoid-immune rabbits with that of normal controls against the toxic products of typhoid bacilli as determined by the length of time the hearts continued to beat after perfusion with liquids containing the toxic products. The second series of experiments was similar to the first except that instead of normal controls animals immunized with bacteria other than typhoid bacilli were used.

In both cases, the resistance of the hearts of typhoid-immune rabbits was greater than that of the controls. Attempts to demonstrate the presence of antitoxin in the fluid from the heart tissue of the immunized animals gave negative results.

These experiments are thought to demonstrate "that permanent acquired immunity, at least in typhoid, instead of being due principally to antibodies, is caused by a lasting specific increase of resisting power acquired by the tissue cells against the toxic products of bacteria. This theory seems to hold good with other infectious diseases in which one attack conveys permanent immunity."

The effect of intravenous injection of mercurochrome on the kidneys, J. H. HILL and C. Y. BIDGOOD (*Bul. Johns Hopkins Hosp.*, 35 (1924), No. 406, pp. 409-411, pl. 1).—The investigations conducted show that intravenous mercurochrome causes a mild reaction in the kidney which is directly proportional to the dose given. "There is no actual destruction of tubular epithelium from doses as high as 7.5 mg. per kilogram of body weight, but with 10 mg. per kilogram there is definite renal damage, so that it would be unwise to use so large a dose clinically. Repeated injections do not cause any added damage and can be given, as in these animals [rabbits], as often as twice a week with safety, provided a dose of 5 mg. per kilogram of body weight be not exceeded. The slight damage is not irreparable, and at the end of two months the kidneys show no evidence of any previous lesion."

On the nature of the heat-labile substance ("V") required for the growth of the bacillus of Pfeiffer, T. THJÖTTA (*Jour. Expt. Med.*, 40 (1924),

No. 5, pp. 671-678).—Evidence along two different lines is presented, indicating that the heat-labile, growth-promoting factor V for the cultivation of Pfeiffer's bacillus (E. S. R., 46, p. 78) is not identical with the antineuritic vitamin B.

As determined by growth experiments with Pfeiffer's bacillus, the blood of pigeons and hens which had developed symptoms of polyneuritis as the result of continued feeding on diets deficient in vitamin B was found to contain as much of the V factor as normally fed controls. The second line of evidence that the two factors are not identical was the difference in thermostability. The growth-promoting substance V was destroyed at 105° C., while vitamin B-containing food did not lose its property of preventing polyneuritis after being autoclaved for 1 hour at 115°.

A filterable virus infection of rabbits.—I-II, C. H. ANDREWS and C. P. MILLER (*Jour. Expt. Med.*, 40 (1924), No. 6, pp. 773-796, pls. 2, figs. 2).—The authors report that in two, and possibly four, of six transmission series of rabbits inoculated with the blood of apparently normal rabbits a virus was recovered having the same properties as that recovered from series originally inoculated with material from rheumatic fever patients. The virus is thought to be a parasite of the domestic rabbit, but up to the present time the natural course of the infection in that animal is unknown.

Infectious abortion (fifth report), G. C. WHITE, L. F. RETTGER, and J. G. McALPINE (*Connecticut Storrs Sta. Bul.* 123 (1924), pp. 281-303, figs. 2).—In the first part (pp. 281-288) of this fifth report (E. S. R., 49, p. 784), the authors deal with investigations of the gestation period of cows. They find the average length of the gestation period of 640 calvings of uninfected animals to be 280 or 281 days. Only 2.87 per cent of the gestations of non-reacting cows terminated before the two-hundred-and-sixty-sixth day. It is said that in frequency distribution a sharp division line occurs on the two-hundred-and-sixty-sixth day, and gestations terminating prior to it may properly be looked upon as abortions due, with relatively few exceptions, to *Bacterium abortus*. Many of the permanently reacting cows were found to be able to carry calves to full time, but over a period of years 26.23 per cent of the calvings terminate before the two-hundred-and-sixty-sixth day. A much higher percentage of reactors than this abort during the gestation in which they first become infected, and only a few reacting cows escape abortion entirely if their career extends over any considerable time. The average length of gestation of 629 reacting cows was 266.9 days, as compared with 279.2 for the 671 nonreacting cows. The authors conclude from these studies that only about 1 in 10 of premature calvings may be attributed to causes other than *B. abortus*. Abortions may occur at any time during the gestation period, but with greatest frequency between the two-hundred-and-twentieth and two-hundred-and-sixty-fifth days.

In the second part (pp. 288-295), which relates to retained afterbirth, the authors report finding that retention apparently occurs as frequently with non-reacting cows as with reactors, which should eliminate *B. abortus* as the chief factor.

Part 3 (p. 295) relates to calf scours, infectious mammitis, and calf pneumonia. These affections have been infrequently met with in the herds badly infected with *B. abortus*, indicating that they occur independent of the *B. abortus* disease.

In part 4 (pp. 295-300) the history is given of the daughters of reacting and nonreacting dams. The conclusion reached is that calves are not permanently infected in utero, nor during early calthood, and, regardless of whether or not the dam is infected, all of the calves run the same hazards and share the same fortunes when they start their reproduction career.

In part 5 (pp. 300, 301), which consists of a brief history of purchased cows, it is stated that 29.1 per cent of the purchased cows reacted, revealing the widespread occurrence of the disease. Forty-nine of the 118 originally nonreacting purchased cows became infected after purchase, and 57.7 per cent of these aborted, showing that mature or nearly mature cows as well as heifers are extremely susceptible to *B. abortus* infection when they are introduced into herds that are badly infected.

The actual state of our experimental knowledge of foot-and-mouth disease [trans. title], M. H. VALLÉE (*Ann. Méd. Vét.*, 69 (1924), Nos. 6, pp. 241-251; 8-9, pp. 337-348; abs. in *Vet. Rec.*, 4 (1924), No. 45, pp. 951, 952).—In his investigations of the virus of foot-and-mouth disease, the author obtained it from the blood of infected cattle in the preeruptive stage of the disease, and not, as formerly, from the lymph of unruptured vesicles. This can be preserved in an undeteriorated state for months in a refrigerator at 0 to 2° C. The investigations have led him to conclude that two strains of virus exist, and these he terms O and A. The period of incubation is found to be longer for the O than for the A strain, and the duration of the period of immunity at least twice as long for the former as for the latter. An extended discussion is given of immunity work.

The specific microorganism of foot-and-mouth disease, C. M. HARING (*Jour. Amer. Vet. Med. Assoc.*, 65 (1924), No. 6, pp. 768-773).—This is a discussion of the addresses presented by P. Frosch and H. Dahmen at Utrecht on June 16, 1924, at a meeting under the auspices of the Netherlands Ministry of Agriculture attended by the author, in which the discovery of the causative organism of foot-and-mouth disease was reported (*E. S. R.*, 52, p. 179).

The California foot-and-mouth disease outbreak, J. R. MOHLER (*Jour. Amer. Vet. Med. Assoc.*, 65 (1924), No. 6, pp. 760-767).—This is a discussion of the outbreak of foot-and-mouth disease in California and the eradication work conducted, which was presented as an address at the annual meeting of the American Veterinary Medical Association, at Des Moines, Iowa, in August, 1924.

Production of immunity in mice by inhalation of pneumococci, E. G. STILLMAN (*Jour. Expt. Med.*, 40 (1924), No. 4, pp. 567-574, fig. 1).—Experiments are reported which indicate that normal mice may be immunized against virulent pneumococci by repeated inhalation of the live organisms.

In 449 mice exposed to from 1 to 10 inhalations of pneumococcus cultures, there were 29 deaths, the greatest number, 10, occurring after the second inhalation. There were no deaths after the first and tenth inhalations. Repeated inhalations of killed organisms resulted in only a slight degree of immunity.

Personal experiences with the cultivation of tubercle bacilli and the use of the guinea pig as a diagnostic test animal for tuberculosis, H. J. CORPER (*Jour. Lab. and Clin. Med.*, 9 (1924), No. 11, pp. 766-776).—This is a summary of the results obtained in a long-continued study of methods of cultivating human and bovine tubercle bacilli and of using guinea pigs as the diagnostic reagent. The chief recommendations resulting from this study are as follows:

The preferred method of isolating tubercle bacilli from tissues and contaminating materials is the Petroff sodium hydroxide method combined with seeding on gentian violet egg medium, to which glycerol is added for human but not for bovine bacilli. After artificial cultivation for over a year the strains are continued on glycerol agar or, in special cases, on glycerol broth. Tubercle bacilli should not be left longer than a month in the incubator or ice box without transfer to a fresh medium.

In guinea pig inoculation, the method of choice is considered to be the subcutaneous injection of the suspected material, properly prepared by pre-

liminary sodium hydroxide treatment and neutralization. The subcutaneous method is preferred to the intracutaneous on account of the greater danger of ulceration and contamination in the latter. The disadvantage of intravenous, intracardiac, and intraperitoneal inoculation is considered to be the necessity for complete examination of the animal before there are visible external signs of the disease. The use of extraneous agents such as Roentgen ray exposure, injection of radioactive substances, etc., is considered not to hasten the development of tuberculosis and is not to be recommended.

Calmette's protective inoculation against tuberculosis, A. K. K[RAUSE] (*Amer. Rev. Tuberc.*, 10 (1924), No. 2, pp. 219-225).—This is a review and an editorial discussion on recent work of Calmette and his associates on immunization against tuberculosis with bile-treated bacilli (*E. S. R.*, 52, p. 282).

On the iodized swine erysipelas vaccine [trans. title], S. FUJIMURA (*Jour. Japan. Soc. Vet. Sci.*, 3 (1924), No. 1, pp. 17-36).—The author reports satisfactory results in the immunization of swine against swine erysipelas with an iodized vaccine, prepared by treating a suspension of 24- to 48-hour agar and broth cultures in salt solution with Lugol's solution (iodine 1, potassium iodide 2, and distilled water 200 parts) in the proportion of 1:5 and allowing it to stand at room temperature for 1 hour, with frequent shaking. The suspension, which is cloudy at first, is allowed to stand for some time or until the supernatant liquid has become clear, when it is ready for use.

After preliminary immunizing experiments with small laboratory animals, the vaccine was injected subcutaneously into 8 pigs, 4 of which received a single dose of 5 cc. and the rest two doses of the same amount. After 15 days the vaccinated animals and 2 controls were injected with 10 cc. of a 48-hour serum broth culture of the organism. The vaccinated animals receiving the double dose and 2 receiving the single dose of vaccine showed no reaction. The other 2 which had been vaccinated showed a slight rise in temperature and a few red patches, while the control animals developed typical symptoms of the disease but recovered.

Agglutination tests carried out on the vaccinated animals before and after vaccination showed an appreciable production of agglutinins.

It is stated that in a district in which swine erysipelas had been prevalent vaccination has been practiced with satisfactory results on over 1,600 animals. The amount of vaccine used was in the proportion of 1 cc. to 10 kg. of body weight. The duration of the immunity conferred by this vaccination has not yet been determined. The vaccine is said to retain its potency under suitable conditions for about a month.

The common parasites of hogs, K. W. STODER (*Iowa Agr. Col. Ext. Bul.* 119 (1924), pp. 12, figs. 3).—This is a practical summary of information on the subject.

The question of the human and pig Ascaris, F. K. PAYNE, J. E. ACKERT, and E. HARTMAN (*Amer. Jour. Hyg.*, 5 (1925), No. 1, pp. 90-101).—This is a contribution from the Kansas Experiment Station, based upon work commenced in Trinidad in 1921 and later continued in Kansas and Virginia. The investigations include (1) experimental feedings of embryonated eggs of human *Ascaris* to pigs and of pig *Ascaris* eggs to primates and (2) studies on the incidence of human and pig ascarids in Trinidad.

"Repeated feedings of infective human *Ascaris* eggs were made to five young pigs, all of which suffered respiratory disturbances and other systemic disorders. Subsequent post-mortem examinations showed no ascarids in the digestive tract of any of the pigs. Severe cases of 'thumps' occurred in all of the pigs fed eggs of the human *Ascaris*. This appears to be the first record of thumps caused by the administration of human *Ascaris* eggs to pigs. Infec-

tive pig *Ascaris* eggs were taken by one monkey and by two human subjects. Fecal examinations made throughout periods of several months after the initial administration of eggs failed to show the presence of any *Ascaris* eggs. The incidence of *Ascaris* in north, central, and southern Trinidad, British West Indies, varied from 20 to 70 per cent for the human *Ascaris* and from 3.5 to 10.8 per cent for the pig *Ascaris*. In the vicinity of Arouca, one of the principal swine raising regions, the incidence of human *Ascaris* was 64.3 per cent, as compared with 10.8 per cent for the pig *Ascaris*. The experimental results indicate that embryonated eggs of the human *Ascaris* will not produce mature ascarids in pigs, that infective eggs of the pig *Ascaris* will not produce mature ascarids in the adult primates (monkey and man), and that there is thus a physiological difference between the human and the pig *Ascaris*."

A list of 13 references to the literature is included.

The blood, urine, and tissue juices in azoturia.—A preliminary report, C. E. HAYDEN and M. TUBANGUI (*Cornell Vet.*, 11 (1921), No. 2, pp. 81-84).—This is a preliminary report of investigations conducted at the New York State Veterinary College at Cornell University. While the data obtained are too limited to establish definite facts, the extractives in the blood seem to be no greater or even less in quantity than those of normal blood. "The quantity of sugar, total nonprotein nitrogen, and preformed creatinine of expressed muscle juice seems to be excessive. This points to retention of these extractives in the tissues rather than an overloading of the blood. The results from urine examinations are not in accord with the expressed idea of a high urea content. The samples analyzed so far do not indicate any marked nephritis."

The blood, urine, and tissue juices in azoturia.—A second report, C. E. HAYDEN (*Cornell Vet.*, 14 (1924), No. 2, pp. 158-165).—The author finds that in the blood of the horse in azoturia there appears to be a moderate average increase in some of the extractives, notably that of the total nonprotein nitrogen and sugar, though this is not true in all cases. Increases in individual cases tend to raise the average, but those cases showing the greatest individual increase are not always the worst cases in so far as clinical symptoms go. There is not enough increase in the extractives in either average or individual readings to justify the claims that the blood is loaded with extractives or that there is uremic poisoning to the extent that it might be the cause of the disease. The quantity of sugar found in average or individual cases so far also does not justify the claim that azoturia might be due to disturbed carbohydrate metabolism. Urine findings so far still do not indicate a nephritis of enough severity to be the cause of azoturia or of an uremia which might be severe enough to cause the disease. The report, however, is not considered as final.

Pyotherapy in the purulent nasopharyngeal affection, so-called contagious pleuropneumonia (grip) in the horse [trans. title], E. BEMELMANS (*Bul. Soc. Cent. Méd. Vét.*, 100 (1924), No. 20, pp. 458-465).—Excellent results are reported in the treatment of equine contagious pleuropneumonia with an autogenous vaccine prepared from nasal secretions by shaking about 4 cc. of the nasal discharge with 30 cc. of a 0.5 per cent phenol solution, heating the mixture to a temperature of 62° C. for 30 minutes, and allowing it to settle. The treatment consisted in the subcutaneous injection in the neck of from 3 to 5 cc. of the clear supernatant liquid, followed by gentle massage at the site of inoculation. Improvement in condition was noted within 24 hours. Occasionally a second injection is considered advisable.

An outbreak of goose septicemia, with notes on the commercial fattening of geese, F. R. BEAUDETTE (*Jour. Amer. Vet. Med. Assoc.*, 66 (1924), No. 2, pp. 145-150).—This is a contribution from the New Jersey Experiment Stations, in which the author reports upon an outbreak of goose septicemia, due to

Pasteurella avium, that occurred in one of the largest goose-fattening plants in northern New Jersey. The geese had been purchased mainly in Illinois and Missouri, being shipped in carload lots of from 1,500 to 1,800 geese. The outbreak was brought under control through isolation and the application of sanitary measures.

RURAL ENGINEERING

The artesian-water supply of the Dakota sandstone in North Dakota, with special reference to the Edgeley quadrangle, O. E. MEINZER and H. A. HARD (*U. S. Geol. Survey, Water-Supply Paper 520-E* (1925), pp. II+73-95, pls. 2, figs. 2).—In cooperation with the North Dakota Geological Survey, the results of a questionnaire survey of the status of about 230 artesian wells in the area are presented and discussed.

The San Juan Canyon, southeastern Utah: A geographic and hydrographic reconnaissance, H. D. MISER (*U. S. Geol. Survey, Water-Supply Paper 538* (1924), pp. V+80, pls. 22, figs. 3).—The results of a survey of the geography, geology, and surface conditions of the San Juan Canyon in southeastern Utah are presented.

A discussion of certain Colorado River problems, G. E. P. SMITH (*Arizona Sta. Bul. 100* (1925), pp. 143-175, fig. 1).—This is a progress report supplementing Bulletin 95 of the station (E. S. R., 47, p. 187).

Surface water supply of Pacific slope basins in Washington and upper Columbia River basin, 1921 (*U. S. Geol. Survey, Water-Supply Paper 532* (1924), pp. VI+222, pls. 2).—This report, prepared in cooperation with the States of Washington, Montana, and Idaho, presents the results of measurements of flow made on streams in the Pacific slope basins in Washington and the upper Columbia River basin during the year ended September 30, 1921.

Base exchange in ground water by silicates as illustrated in Montana, B. C. RENICK (*U. S. Geol. Survey, Water-Supply Paper 520-D* (1924), pp. II+53-72, pls. 3, fig. 1).—Studies of ground water in an area of Lance and Fort Union formations in east-central Montana in the Great Plains province are summarized.

The results showed that near the surface the water is relatively high in calcium and magnesium, which, with increasing depth, are exchanged for sodium and perhaps potassium, the result being a natural softening. The minerals of the leverrierite group, which are plentiful though disseminated in these formations, and are believed to be derived from the decomposition in place of the glassy constituents of rock fragments, are considered to be the principal agents in effecting this exchange of bases, although the exchange may be aided by such minerals as kaolinite, feldspar, and mica. This exchange of bases is accomplished at a depth of 125 ft. or less. There is no tendency for the water to acquire more dissolved material with increasing depth. The amount of total dissolved solids is therefore determined relatively near the surface.

Effects of storage on artificially polluted waters, R. C. FREDERICK (*Analyst*, 49 (1924), No. 575, pp. 63-73).—Studies into the chemical changes which occur in excretally polluted water in storage are reported. The findings were coordinated with the results of analyses of nearly 1,000 samples of water from every type of source throughout the British Isles.

Studies to determine comparatively the changes taking place in water polluted with urine, with an equal quantity of feces, and with the same weight of a mixture of equal parts of urine and feces showed that the chemical changes in samples take place comparatively slowly, and that quite different results are obtained according to the nature of the pollution. The analytical results showed that if pollution of the water is very recent, the evidence in

the samples will be more pronounced if the analysis is actually delayed for a considerable period.

It was further found that in the case of a very recent pollution, particularly urinary, the free ammonia obtained by distillation is not infrequently evolved in a large number of fractions, each of which after the first few contains about the same amount as that immediately preceding. In samples in which the pollution is more remote, the free ammonia is completely evolved in a small number of fractions which show progressively a distinct fall in amount.

Recent pollution is indicated by distinct evidence of free ammonia. It was found that, of waters considered fit for potable purposes, none contained free ammonia in excess of 0.003, albuminoid ammonia in excess of 0.008, or nitrites in excess of 0.0001 part per 100,000, after excluding samples which could have derived these substances from other than excretal sources. It is concluded that these are the limits which, if exceeded and a nonexcretal origin can be excluded, provide definite evidence of excretal pollution. It is also concluded that the nitrates should not exceed 0.05 part per 100,000.

It is pointed out that it is not necessary to exceed all these figures to cause suspicion. A distinct excess of any one is sufficient, although the occurrence of only a single abnormality is said to be uncommon. Attention is drawn to the fact that, in the polluted waters considered, the limit for free ammonia was not exceeded in 32 per cent of the cases, for albuminoid ammonia in 16, and for nitrites in 14 per cent.

It was further found that exposure of samples of water to light resulted in an enormous increase in the albuminoid ammonia content due to the growth of algae, but for all practical purposes there was no effect on the rate of production and the amount of free ammonia and nitrites. This is considered proof that there is a fallacious increment to and not a decrement from the indications of pollution on storage in light as is commonly supposed.

The presence of 0.1 part per 100,000 of copper sulfate in samples stored in the dark very greatly restrained the production of free ammonia and entirely inhibited its oxidation into nitrites and nitrates, thus preventing to a great extent the creation of evidence of original pollution. Chlorination to the extent of 3 parts per 1,000,000 of samples stored in the dark completely prevented, for all practical purposes, the production of free ammonia, nitrites, and nitrates, and even one-fourth of this amount of chlorination was only slightly less effective.

Size and depth of sand for filters (*Engin. and Contract., Water Works*, 62 (1924), No. 4, pp. 827, 828).—The results of tests conducted by C. M. Daily on the size and depth of sand in seven water filters are briefly reported.

It was found that good water may be obtained with a 12-in. bed of sand by sacrificing the length of run through the use of fine sand. No sand finer than 0.38 mm. is considered to be desirable in a filter bed, and sand coarser than 1 mm. did not appear to be of any value. It is considered doubtful if any advantage is secured by having a greater depth than 24 in. of sand in a filter. Sand 24 in. deep composed of four layers, including (1) a 2-in. depth graded from 0.38 to 0.49 mm., (2) a 6-in. depth graded from 0.49 to 0.62 mm., (3) a 10-in. depth graded from 0.62 to 0.82 mm., and (4) a 6-in. depth graded from 0.82 to 1 mm., was found to give satisfactory results.

It was further found that where sand grains become coated with calcium deposits smaller sized grains should be used, and that the rate of filtration may influence the character of the effluent for any grading of sand. The effluent after washing was first clear, then became turbid, and after a period of from 30 to 45 minutes, running at one-fourth rate, became clear and remained so even after raising the rate until the tests were concluded. The best effluent was produced after 3 hours in service. It was found that the

agar count in the effluent may not vary as the turbidity varies, but that it roughly follows the same changes.

Revenue report on the irrigation works of the Ajmer-Merwara District for the year 1922-23, E. C. GIBSON ET AL. (*Ajmer-Merwara Irrig. Works Rev. Rpt.*, 1922-23, pp. 21, pls. 2).—The text of this report is given.

Public Roads, [January, 1925] (*U. S. Dept. Agr., Public Roads*, 5 (1925), No. 11, pp. 26, figs. 14).—This number of this periodical contains the status of Federal-aid highway construction as of December 31, 1924, together with the following articles:

The Supporting Value of Soil as Influenced by the Bearing Area, by A. T. Goldbeck and M. J. Bussard (see below); Highway Research Board Proceedings, by J. L. Harrison; Recent Conclusions in Highway Research, by A. T. Goldbeck; Comparisons of the Strength of Concrete in Tension and Compression, by N. M. Finkbiner (see below); Highway Income from the Motor Vehicle, by H. R. Trumbower; and Highway Transportation Courses, Their Place and Content, by C. L. Raper.

Comparisons of the strength of concrete in tension and compression, N. M. FINKBINER (*U. S. Dept. Agr., Public Roads*, 5 (1925), No. 11, p. 14).—Studies conducted by the Oregon State Highway Commission are briefly reported, indicating that under general field conditions in Oregon the compressive strength of concrete in pounds per square inch divided by 10 will give approximately the strength of the concrete in tension at the age of 28 days.

The supporting value of soil as influenced by the bearing area, A. T. GOLDBECK and M. J. BUSSARD (*U. S. Dept. Agr., Public Roads*, 5 (1925), No. 11, pp. 1-4, 8, figs. 9).—Studies are reported which showed that when a given unit of load is applied to a soil over various areas, the depth of penetration is directly proportional to the square root of the area over which the load is applied. The general form of the relation expressed mathematically is

$\frac{p}{P} = \sqrt{\frac{a}{A}}$, in which p and P are the penetrations resulting from the application of a constant unit load to areas a and A .

The above relation was established experimentally, and was also developed mathematically on the assumption that for any particular soil the areas under pressure at different depths are confined within lines of like inclination extending from the boundaries of the bearing areas.

The viscosity of oils at high temperatures, A. R. FORTSCH and R. E. WILSON (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 789-792, figs. 3).—Due to the lack of data on the viscosity of oils at temperatures above 212° F., data and curves covering viscosity determinations on a wide variety of oils from Midcontinent and similar crudes up to a temperature of 495° are presented. The curves are discussed, and a method of interpolation is outlined by which it should be possible to obtain to within a few per cent the viscosity of practically any oil derived from Midcontinent or other intermediate base crude at any temperature up to 550°, given a single reliable determination of its viscosity at ordinary temperatures.

Does the zn/p function fit the facts? A. E. BECKER (*Indus. and Engin. Chem.*, 16 (1924), No. 8, pp. 856, 857, figs. 3).—Data are presented which are taken to indicate that the theories which have been advanced in regard to the zn/p relation in the lubrication of bearings fail to fit the facts. This relation is that, for a given bearing and a given oil, changes in the coefficient of friction are determined largely by the modulus zn/p , in which z is the viscosity of the oil at the temperature of the oil film, n represents the revolutions per minute, and p is the nominal pressure on the bearing in pounds per square inch.

Industrial electricity, W. H. TIMBIE (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1924, pp. XIII+735, figs. 469*).—This is one of the Wiley Technical Series, and its purpose is to explain how direct current electricity is generated, transmitted, and used, and to afford an adequate foundation for further study in the application of alternating current electricity to modern practice. It contains chapters on power and power transmission; Ohm's law; distributing systems; electric power; electrical properties of wire; methods of measuring resistance; magnets and magnetism; electromagnets; the magnetic circuit; generators; motors; armature winding and commutation; further applications; inductance; dielectrics, insulators, and condensers; electrochemistry; electrical measuring instruments; and vacuum tubes and gaseous conduction.

Some research features of the application of electricity to agriculture, R. W. TRULLINGER (*Agr. Engin., 5 (1924), Nos. 8, pp. 180-185; 9, pp. 203-208*).—A preliminary analysis is given of some of the more important research features involved in the application of electricity to agricultural processes along the lines discussed editorially (*E. S. R., 51, p. 301*).

Artificial haymaking (*Impl. and Mach. Rev., 50 (1924), No. 594, pp. 654, 655, fig. 1; also in Engineering [London], 118 (1924), No. 3068, pp. 554, 555, figs. 2*).—A brief account is given of studies conducted by the Institute of Agricultural Engineering Research of Oxford University, England, on the artificial drying and curing of hay. Investigations on the consolidation of the stack, porosity of the material in relation to penetrability, design of the chamber around which the stack is built, and the design of the fan resulted in the development of a central chamber that permits of equal penetration of the air in the stack.

It has been found that the requirements of proper drying are met best by using a cone-shaped structure in a circular stack. The slope of the side of the structure is based on turbulence, consolidation of the crop, and the porosity at different levels. A special air preheating arrangement is used in which the air is drawn by a fan over several hot spots or spiral heat conductors heated by paraffin fires under pressure. This air passes out of the heating chamber through a duct into the central chamber in the stack, from whence it passes uniformly to all parts of the mass. It has been found advisable to restrict the size of the stacks to from 10 to 25 tons, and to build them regularly to avoid uneven distribution of the air. The hay is stacked immediately after cutting, and blowing with preheated air is started as soon as the stack is completely made. It has been found that under ordinary circumstances a stack containing excess moisture will gradually heat until a temperature of 120° F. is reached. Fermentation then sets in and causes a rapid rise to about 150°, which is sufficient to kill many of the bacteria responsible for the heating. At such a stage, however, there is danger of another rapid rise due to ordinary chemical oxidation. In the drying process there is no need for the stack to rise above 100°, and fermentation is completely arrested.

The hay made by this process has been of a green appearance and has a pleasant smell and good taste. On the other hand, hay made in the ordinary way has some of its chemical constituents destroyed by the sun and prolonged exposure. Nutritive elements of the artificially cured hay are also said to be preserved to a greater extent. It is noted that the artificial method of curing is also being extended to corn drying.

Heat loss through wall constructions, A. KOLFLAATH (*Jour. Amer. Soc. Heating and Ventilating Engin., 30 (1924), Nos. 9, pp. 627-643, figs. 7; 10, pp. 661-668, figs. 4*).—Experiments conducted at the Norway Institute of Technology on the principles governing the loss of heat through the walls of 27 different test houses built in an open field are reported. The houses had inside

dimensions of 6.6 by 6.6 by 7.5 ft. The data obtained are analyzed primarily for the purpose of indicating their application in the determination of heat transmission coefficients of different types of wall construction.

Tests on the hydraulics and pneumatics of house plumbing, H. E. BABBITT (*Ill. Univ., Engin. Expt. Sta. Bul. 143* (1924), pp. 80, figs. 31).—Studies to obtain information concerning the positive and negative pressures found in soil stacks, waste pipes, traps, and vent pipes, and also concerning the limitations of rates of discharge and the capacities of waste pipes and soil stacks are reported. Various diameters, lengths, and arrangements of pipes, traps, and vents were tested.

The maximum change of level of the water in a trap resulting from the application of pressure was found to be approximately the same for all diameters of traps, provided they are sufficiently large to render the effect of friction in retarding the movement of water negligible. The minimum diameter of trap to satisfy this condition seemed to be about 1 in. This is taken to indicate that for practical purposes in plumbing design the change of level of the water in traps will be the same under the same application of pressure, regardless of the depth of water in the trap.

The withdrawal of water from a trap was found not to weaken its resistance to the passage of air, provided the volume of water remaining in the trap was sufficient to fill the connection between the two legs and to form a vertical column of a height equal to the depth of seal in that leg of the trap in which the water rises. The resistance of a trap to the passage of air through it was found to vary directly with the depth of the seal. It is concluded that for safety in plumbing design it should be assumed that a water closet, other than the automatic valve type, may discharge at the rate of 50 gal. per minute for 7 seconds.

With unvented traps the pressure was found to vary as the five-halves power of the rate of discharge down the soil stack. With vented traps the pressure varied as some constant power of the rate of discharge, depending upon the type and capacity of the vent, and varying between about one-third for very complete venting and five-halves for no vent. The positive pressure in unvented traps was found to vary as the five-halves power of the height of fall of the water to the point of observation. Neither positive nor negative pressures were produced above the point of entrance of water to the soil stack. The negative pressure was found to be dependent both upon the vertical distance the water falls to the point where the negative pressure is measured and upon the vertical fall below this point. The greatest positive pressure is greater than the greatest negative pressure anywhere in a soil stack.

The maximum rate at which water will flow down a 4-in. soil stack without creating uncontrollable pressures in a plumbing system was found to be high, and a 2-in. pipe is considered to be unsuitable for use as a stack. The rates at which one horizontal waste pipe of the same diameter as the soil stack will discharge water into a soil stack through a sanitary T without backing up in the waste pipe were found to be for a 2-in. soil stack 25 gal. per minute for 7 seconds, for a 3-in. soil stack 50 gal., and for a 4-in. soil stack 100 gal.

The submergence of the house drain resulted in a material increase in the pressures created in a plumbing system. Since the use of a house trap, either vented or unvented, at the end of the house drain increases the pressures throughout the plumbing system, it is concluded that such a trap should not be used. Closures of the top of the soil stack or of vent pipes were found to result in such increases of pressure as to endanger the seals in trap.

House painting, A. H. SABIN (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1924, 3. ed., rev. and enl., pp. XV+160*).—This is a practical treatise on house painting, glazing, paper hanging, and whitewashing.

RURAL ECONOMICS AND SOCIOLOGY

Farming partnerships in Tuscany as exhibited in some medieval documents [trans. title], A. CASABIANCA (*Atti R. Accad. Georg. [Florence]*, 5. ser., 20 (1923), No. 2-4, pp. 19-28).—These notes describe some of the earliest farming partnership contracts and references to the system found in the medieval literature of Italy, certain of them dating back to the sixth century. The earliest actual authentic document of such a contract is said to bear the date of August 17, 1224.

More profit for the wheat farmers of central Kansas, J. W. TAPP and W. E. GRIMES (*U. S. Dept. Agr., Farmers' Bul. 1440* (1924), pp. II+14, figs. 11).—This is based upon data which have been noted (*E. S. R.*, 52, p. 588).

Costs, profits, and practices of the sweet potato industry in New Jersey, 1922, A. G. WALLER and H. B. WEISS (*N. J. Dept. Agr. Circ. 70* (1923), pp. 55, figs. 17).—Survey data collected in the field covering the year 1922 are incorporated in these pages, together with information as taken from official reports and other sources. New Jersey is found to rank second in the number of cars of sweet potatoes shipped, and with a production of less than 5 per cent of the total crop to ship to market from 15 to 20 per cent of the total car lot shipments.

The cost of producing sweet potatoes in New Jersey in 1922 was \$167.78 per acre or 94.9 cts. per bushel, the cost of growing plants amounting to \$18.57 per acre, preparing the seed beds \$13.27, planting and caring for the crop \$34.04, and labor and materials up to the point of harvesting \$91.60. Harvesting, including storage, containers, labor, and insurance, cost \$64.96, and interest on land or land rental was estimated at \$8.87. Man labor was the largest single item of expense, representing 43.7 per cent of the total cost. Next in order were fertilizer 10.4, containers 10.4, horse labor 9.9, land rental 5.3, and manure 4.2 per cent. An average of over 21 days of man labor per acre were required to raise the crop. Of the total production 34.3 per cent was produced at a cost of 80 cts. or less per bushel, 7.8 per cent at \$1.41 or over, and the bulk of the crop within the range of 81 to 140 cts. per bushel. The farms producing 100 bu. or less had an average cost of \$1.56 per bushel, while those producing 251 bu. and over per acre had an average cost of 66 cts. per bushel. The average yield per acre in 1922 was 176.7 bu., in comparison with the 10-year average of 129.

New Jersey has storage facilities for over 375,000 bu. of sweet potatoes, or a capacity for at least 10 or 15 per cent of the total crop. Over a period of years it has been found slightly profitable to store; during the 5-year period, 1918-1922, it was more profitable.

The cost of raising swine under existing conditions in the College of Agriculture, D. B. PEÑA (*Philippine Agr.*, 12 (1924), No. 10, pp. 469-479, fig. 1).—An experiment begun August 11, 1920, and ended December 1, 1921, at the College of Agriculture of the University of the Philippines was intended to determine the profits of hog raising under conditions existing at the college and to discover the relation of the proportion of Berkshire blood to the rapidity of growth of pigs. Not including pigs that died, 73 pigs, 9 sows, and 11 litters were used in this study. The growth data are briefly discussed.

The economic phase was carried out by recording the labor, feed, and disinfectants used, the depreciation on equipment, the rent of land and sows, and depreciation on the sows. The sum of these items was subtracted from the sum of the revenue derived from the sale of products to show the net return. The gross income from the 73 pigs, 23 of which were sold for breeding and 50 for meat, was ₱2,161.23. The total expenses were ₱1,772.77, making a net income of ₱388.46, which is calculated as 30.5 per cent of the average invest-

ment for the period of $1\frac{1}{2}$ years, or 22.9 per cent per annum. Conditions are considered to have been more favorable in this experiment than at normal times. Under existing conditions at the college, the project was profitable when the retail price of pork was ₧1.20 a kilogram. After deducting all costs of operation, the managerial income of the operator was ₧291.65 per annum.

The depreciation of the currency and its effects on agricultural credit in Germany. W. VON ALTROCK (*Internatl. Rev. Agr. Econ.* [Rome], n. ser., 2 (1924), No. 2, pp. 163-193).—The credit system of the *Landschaften* in Germany made it impossible for these institutions to take into account the changed conditions in money values of the postwar period, and their method of obtaining capital by issuing mortgage bonds met with difficulties. The nominal value of their capital in relation to the fall in the mark was increased by raising the estimated values of buildings and other assets. The *Landschaft* bonds and other mortgage bonds are said to be no longer adapted to the needs of the period, and a substitute has been found for them in certificates of the sale of rye and bonds on a basis of rye values.

A rye bond bank making loans on mortgage securities was founded as a limited liability company by the society for the settlement of new lands at Berlin. Another banking enterprise was founded in November, 1922, on a somewhat similar basis, mainly to encourage land improvement. Its object is particularly the financing of large land improvement schemes. In the spring of 1923 the Central *Landschaft* for the Prussian States decided to grant rye loans and to issue rye bonds. Various other enterprises are noted, including the activities of cooperative and other organizations providing personal credit.

The higher finance of agricultural co-operation in India. H. CALVERT (*Internatl. Rev. Agr. Econ.* [Rome], n. ser., 2 (1924), No. 2, pp. 231-239).—Numerous devices were resorted to in order to meet the demand for an outside financing agency for cooperative societies in India. Central provincial banks, banking unions, and certain intermediary institutions are described in this paper.

The organization and development of cooperative fire insurance companies in New York. R. W. BARTLETT (*New York Cornell Sta. Bul.* 435 (1924), pp. 36, figs. 7).—The costs and some of the factors contributing to the success of these companies are set forth on the basis of data compiled since 1910 as obtained from State insurance reports.

On January 1, 1923, there were 166 cooperative fire insurance companies in New York State operating in 58 counties. They were of two general types, 135 assessment and 31 advance premium companies. It is estimated that of the total insurance on insurable farm property in the State approximately 90 per cent was written by cooperative companies. Of the total insurance of cooperative companies, 72 per cent was written by assessment companies in 1923 and 60 per cent by county assessment companies. The latter are said to be probably the most satisfactory type, since their losses and expenses are somewhat lower. Losses were found to have been greater in counties where low land values prevail than in those of high land values. The success of cooperative fire insurance companies is largely due to the fact that they have given reliable insurance at reasonable cost.

Tax revision in Kansas. E. ENGLUND (*Kansas Sta. Bul.* 234 (1924), pp. 3-95, figs. 8).—Data have been compiled from the Federal census and other official sources, and some information from an earlier investigation (E. S. R., 52, p. 294) is used in support of a statement of the principal reasons why tax revision is needed in Kansas. A program involving changes in the valuation of property for taxation and the institution of a State personal income tax and a tax on mineral and oil lands and on gasoline is outlined.

Wheat forecasts in the Punjab, H. K. TREVASKIS (*Agr. Jour. India*, 19 (1924), No. 3, pp. 232-250).—Crop statistics are said to have been collected originally in the Punjab for land revenue purposes, and an inevitable tendency toward underestimating the outturn was involved. The development of wheat export and the increased anxiety on the part of the Government to secure an adequate supply of food for the population have given rise to a demand for statistics free from bias. A method of gathering and checking village estimates for outturn, consumption, and stocks in hand is presented.

The statistical measurement of the elasticity of demand for beef, H. SCHULTZ (*Jour. Farm Econ.*, 6 (1924), No. 3, pp. 254-278, figs. 8).—The problem dealt with in these pages is that of determining the effect of a tariff on the price paid by the consumer, on consumption, and on imports and profits in the cattle industry. Statistical data were found to be available with respect to the total quantity of beef slaughtered under Federal inspection in the United States and the prices at Chicago of native beef cattle per 100 lbs. live weight. The period covered by these statistics includes 73 months from January, 1907, to January, 1913. The method of trend ratios was used in eliminating disturbing factors influencing the price of beef, deriving the demand curve from the ratios of the data to their respective trends. When the production ratios and price ratios are plotted they exhibit a fair inverse correlation, although the effect of an increase in production upon prices is found to be not immediate. The tendency, however, is for prices to decline as production increases.

The elasticity of the domestic demand is derived and found to be about -4.5. Its margin of error is indicated, and some possible objections, both to the data and the method, are anticipated and discussed. The data which are necessary for the derivation of the coefficients of the domestic and foreign supply are said to be lacking. It is held that the effect of the tariff on beef is an example of a case where the demand is elastic and the tax is levied on the elastic supply, and that the increase in price due to the tariff is not so great as it would have been had our demand been inelastic, but not so small as it might have been had the foreign (taxed) supply been less elastic than the domestic (untaxed) supply. The quantitative answer to the problem set is deemed still unanswerable until further statistical data are available.

The determination of hog prices at public markets, E. N. WENTWORTH and T. U. ELLINGER (*Jour. Farm Econ.*, 6 (1924), No. 3, pp. 279-282).—This study is based upon prices of hogs and pork products as exhibited in data published by the U. S. Department of Agriculture, comprising the items of the monthly receipts of hogs at Chicago, the monthly average prices of medium weight hogs at Chicago, and monthly price quotations at eastern points on fresh pork loins, breakfast bacon, smoked hams, picnic shoulders, and lard. The quotations cover the period of 46 months from January 1, 1920, to October 31, 1923.

The relationships between six of the variables mentioned have been correlated in all combinations of two. The relative size of these coefficients indicates that prices on live hogs are more closely correlated with prices on cured pork products and lard than with loin prices. This fact suggests that live prices are, therefore, more definitely determined by them than by loin quotations. The multiple correlation between live prices and the combined six other variables has been calculated. Four conclusions are drawn as follows:

(1) If receipts were constant and provision prices were constant, hog prices would display no appreciable variation. (2) Current hog quotations do, to a remarkably high extent, reflect the number of animals marketed by the producers as well as the prices which the consuming public is willing, at that particular time, to pay for the finished products in the volume available for

sale. (3) The six factors included in this analysis account for practically all variations in the average monthly hog prices, and other suspected causes of fluctuations either neutralize each other or are insignificant. (4) For the period covered by the study, it appears that the cause of price variations in live hogs originated outside of the marketing system and in the field of production or consumption.

Interim report on meat, poultry, and eggs, MARQUESS OF LINLITHGOW ET AL. (*London: Min. Agr. and Fisheries, 1923, pp. 185, figs. 7*).—This is another one of the reports of the departmental committee on distribution and prices of agricultural produce in the same series previously noted (*E. S. R.*, 50, p. 690). The oral evidence obtained in the course of the investigation consisted largely of details of private and in many cases of competitive businesses. Furthermore, questionnaires were furnished to meat retailers throughout Great Britain, of which between 700 and 800 were returned complete. Information with reference to meat is presented in sections on statistics of live-stock and meat, methods of marketing stock and of distribution of fresh meat and bacon, costs of marketing livestock, slaughterhouses and slaughtering charges, costs of distribution of meat and bacon, the price structure, meat markets and depots, insurance against condemnation of meat, cooperation of producers, and the imported meat trade and empire supplies. That with respect to poultry and eggs is covered in sections on production and consumption, methods and costs of marketing and distribution, preparation for market, packages, and cooperation of producers.

Cold-storage holdings to October, 1924 (*U. S. Dept. Agr., Statis. Bul. 4 (1925), pp. 32*).—The statistics in this bulletin, prepared by the Bureau of Agricultural Economics, are presented in revision of earlier information (*E. S. R.*, 49, p. 892).

Crops and Markets, [January, 1925] (*U. S. Dept. Agr., Crops and Markets, 3 (1925), Nos. 1, pp. 16; 2, pp. 17-32; 3, pp. 33-48, fig. 1; 4, pp. 49-64; 5, pp. 65-80*).—Statistics are tabulated from current weekly market reports covering important classes of agricultural products and specific commodities, and brief special articles are given, reviewing their situation in the market. Foreign crops and markets notes are also presented.

Agriculture and American business, J. H. BARNES (*In The Genius of American Business. Garden City, N. Y.: Doubleday, Page & Co., 1924, pp. 42-51*).—This chapter from a book of collected addresses puts forth the conviction that agriculture in the United States is in a secure position, and emphasizes the need for expansion of railroad facilities as one means of preserving it.

Agriculture and foreign relations, J. H. BARNES (*In The Genius of American Business. Garden City, N. Y.: Doubleday, Page & Co., 1924, pp. 52-61*).—Another chapter from the book noted above discusses the interest of the American farmer in the restoration of buying power in Europe, reviewing the position of Germany, France, Great Britain, and Italy as the chief customers for the products of American agriculture.

European economic conditions which affect the markets for agricultural products, H. B. SMITH (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 235 (1924), pp. II+62*).—Questions relating to the purchasing power, productive ability, labor conditions, social and financial stability, and industrial and agricultural activity in the principal countries of Europe are covered in this bulletin. One of the facts of prime significance brought out is that, according to the best estimates available, industrial activity in Europe is on a level only 60 or 70 per cent as high as before the war. The economic situation of individual countries is set forth in some detail. It is held that most of Europe has been and is financing its trade through measures which are

neither sound nor constructive, and which place a limit upon the extent to which they can be made effective in the future.

The future of wheat export from the United States, A. E. TAYLOR (*Kans. State Bd. Agr. [Quart.] Rpt., 43 (1924), No. 169, pp. 35-51*).—The author discusses the position on the world market of wheat exported from the United States. It is declared that expansion of production is to be expected in Canada, Argentina, and Australia, as well as in Russia. A number of price fixing and marketing schemes are discussed. The Coulter plan providing for extension to wheat growers of already existing governmental credit facilities with specified application of the credits to diversified farming and particularly the purchase of animals is favored as sound and constructive. Farmers were advised to restrict operations in 1923-24 to the domestic basis, and it is held that they should not be told that experiences and precedents in cooperative marketing warrant the expectation that such collective organization would raise the price of wheat sold in the export market.

Permanent agriculture, population restriction, and national progress, E. M. EAST (In *Mankind at the Crossroads. New York and London: Charles Scribner's Sons, 1923, pp. 146-198, figs. 4*).—This chapter from the author's book on population and the food supply comprises a brief sketch of the agricultural situation in the United States in its relation to population problems, which brings together data from several official and other sources with regard to the limitations upon natural resources, as well as a discussion of problems of agronomy bearing upon the future food resources of the United States and the world and the probable development of the agricultural industry.

The agricultural regions of North Dakota, R. E. WILLARD (*North Dakota Sta. Bul. 183 (1924), pp. 5-168, figs. 64*).—The material presented here has been assembled from a number of official sources, and constitutes a survey of the physical and climatic features of the State, the principal regions for the production of particular crops, yields, relative damage to crops, the agricultural belts of the State, and crop production trends. A synopsis of North Dakota agriculture is given by counties.

Rural social survey of Hudson, Orange, and Jesup consolidated school districts, Black Hawk and Buchanan Counties, Iowa, G. H. VON TUNGELN and H. L. EELLS (*Iowa Sta. Bul. 224 (1924), pp. 201-251, figs. 18*).—The report is made of a detailed survey of 385 farm homes and farm families, which was conducted by means of personal interviews during the year 1920-21. Information is presented showing the nationality and marital condition of the population, the size of families, and the economic, social, educational, and religious conditions which prevail in these regions among both tenants and owners. In general, about 75 per cent of the young people declared their intentions of remaining on the farm, and from 55 per cent in Jesup to 94 per cent in Orange district of the tenants who did not own land showed that they expected to become farm owners. The appendix compares the results of an earlier survey of the Orange district (E. S. R., 40, p. 593) with those of the year 1920-21.

Monthly Supplement to Crops and Markets, [January, 1925] (*U. S. Dept. Agr., Crops and Markets, 2 (1925), Sup. 1, pp. 32, figs. 3*).—The results of the December 1 pig survey, tabulated data showing the utilization of the corn crops of 1923 and 1924, and a survey of the world flaxseed production, together with reviews of the 1924 produce season and the production of certified seed potatoes and statistics of American cotton consumption, 1924, with comparisons, are featured in this issue. The usual estimated farm prices of important products and statistics of the livestock and meat situation and of fruit and vegetable shipments and prices are presented.

Horses, mules, and motor vehicles (*U. S. Dept. Agr., Statis. Bul. 5* (1925), pp. 95).—Statistics for the year ended March 31, 1924, with comparisons, compiled in the Bureau of Agricultural Economics from commercial and official sources, are presented in 104 tables showing the numbers, receipts, shipments, exports and imports, costs of raising and prices of horses and mules, and the production, uses, costs, and other items with respect to motor vehicles.

Agriculture [in Algeria in 1923] [trans. title], T. STEEG ([*Gouv. Gén. Algérie*] *Exposé Situation Gén. Algérie, 1923*, pp. 501-507, 525-528, 558-562, 585-705).—The annual report with reference to the encouragement of agricultural interests by the Government of Algeria is submitted, continuing the series previously noted (*E. S. R.*, 50, p. 193).

AGRICULTURAL EDUCATION

Report of the committee on agricultural education and research in Scotland, A. H. B. CONSTABLE ET AL. (*Edinburgh: Govt., 1924*, pp. 54; *abs. in Scot. Jour. Agr.*, 7 (1924), No. 4, pp. 401-404).—This committee report gives a short summary of the development of agricultural education in Scotland from 1790 onward, and traces the rise of teaching centers at Aberdeen, Edinburgh, and Glasgow, respectively.

The growth in expenditure at these three collegiate centers is noted, the gradual increase in the proportion of State to local contribution being specially brought out. The existing organization of the colleges and their methods of working are described, the extension work in the counties is noted in some detail, and the general results of the whole system are reviewed. The relations between the universities and the colleges are considered in view of a suggestion made to the committee that all the higher scientific teaching should be left to the universities. Suggestions are made for modifying the curricula at the colleges and for encouraging a certain amount of specialization at each center in relation to the prevailing types of agriculture in the respective areas. Evidence pointed to the fact that the governing boards of the colleges have grown too big, and the committee proposes reconstruction of these bodies.

A section of the report is devoted to a discussion of the problem of rural education, which, in the opinion of the committee, is the most difficult of those reported upon. It is recommended that an experiment be made in establishing one or two residential schools offering short courses to farmers' sons along the lines of the inexpensive schools in Denmark, Norway, and Sweden. Special training in women's work on the farm is also recommended, and the value of the work of women's rural institutes in this connection is recognized.

The 30 specific recommendations of the committee are drawn up with regard to agricultural education, research, and veterinary colleges. With regard to research, it is deemed important to encourage further investigation in animal diseases and plant breeding. It is declared that Rowett Research Institute should be provided with an experimental and demonstration farm, and that a research institute should be established in connection with the National Dairy School at Kilmarnock. The systematic recording and analysis of data necessary for agricultural cost studies should be resumed and extended, and provision should be made for special research in plant pests and diseases. It is recommended that careful consideration should be given to the suggestion for a limited tax on agricultural land as one means for raising special funds for agricultural research.

[Seventh and eighth reports with reference to the work of the Federal Board for Vocational Education in agriculture and home economics] (*Fed. Bd. Vocat. Ed. Ann. Rpts.*, 7 (1923), pp. 37-54, 67-88, pl. 1, figs. 6; 8 (1924), pp. 54-66, 80-89, pls. 3, figs. 7).—Portions of these annual reports set forth part-time and other teaching of vocational agriculture, as well as research, service activities, and cooperative teacher training work in 1923 and 1924.

Orchard improvement instruction in Herefordshire, A. J. MANNING (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 4, pp. 355-360, pl. 1).—In 1912 annual competitions were planned for five years as a part of a scheme for orchard improvement. After the Armistice was signed, the further development of horticultural education in the county was provided for by the organization of systematic training of classes of about six men in pruning and grafting. Classroom lessons in fruit growing have been given in connection with the winter courses in agriculture for young farmers.

Students' competitions at agricultural shows, A. GREGG (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 4, pp. 349-354).—Student competitions at agricultural and at fat stock shows in Cornwall are described, and the score cards used are exhibited.

Manual in agriculture: Growing things (Pierre, S. Dak.: Dept. Pub. Instr., 1924, pp. 176, figs. 135).—Teaching material and suggestions are presented for use in the schools of South Dakota in connection with the State course of study.

Crop production and soil management, J. F. COX (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1925, pp. XXX+516, figs. 225).—A handbook for students of crop production and soil management problems in vocational schools or colleges or for practical farmers is presented. Part 1 includes chapters dealing with farm operations, while part 2 covers the growing of specific crops.

Studies in horticulture, J. W. LLOYD, edited by E. DAVENPORT (*Chicago: Rand McNally & Co.*, 1924, pp. VIII+421, figs. 192).—This is designed for use as a text and guide in high schools giving two or more years of instruction in agriculture, one of which is devoted to horticulture. It covers the two branches of the subject, namely, fruit culture and vegetable gardening, selecting for treatment a few kinds of fruits and vegetables considered most important in the groups to which they belong. Chapters are included covering briefly the preservation and the selling of vegetables. Suggested home projects and a list of references constitute two appendixes.

Lessons for pig club members, R. B. MILLIN (*Mont. Agr. Col. Ext. [Pub.] No. 68* (1924), pp. 46, figs. 19).—Eighteen elementary lessons in pig production and care are suggested.

Poultry raising for club members, D. H. HALL and J. H. NEELY (*Clemson Agr. Col. S. C., Ext. Bul. 65* (1924), pp. 43, figs. 14).—This has been prepared for the guidance of boys and girls engaged in the second-year activities of the boys' and girls' poultry clubs of South Carolina.

Boys' and girls' club work: Clothing handbook (*Maine Agr. Col. Ext. Bul. 149* (1924), pp. 36, figs. 37).—This gives concise information on the processes involved in garment making, the selection and care of clothing, and the recognition of textiles.

Essentials of sewing, R. C. COOK (*Peoria, Ill.: Manual Arts Press*, 1924, pp. 238, figs. 162).—This textbook is designed as an aid to teachers and to assist students in solving the problems of garment making in school and at home.

The country theatre, H. A. SECKERSON (*Conn. Agr. Col. Ext. Bul. 80* (1924), pp. 16, figs. 3).—The growth of the little country theater movement in Connecticut is set forth. Books on dramatics and plays adapted to amateur production are suggested.

NOTES

California University and Station.—The last legislature appropriated \$135,000 for the construction of two units of a plant to house the activities of the divisions of agricultural engineering and irrigation investigations and practice.

Twenty-three acres of land recently acquired in Berkeley for the use of the College of Agriculture are being placed in condition. Five acres adjoin the campus and the remainder are about a mile distant.

A cold storage unit has been installed in the truck crops laboratory at Davis, making available much needed facilities for this division.

The technical series of station publications has been superseded by a serial entitled *Hilgardia, a Journal of Agricultural Science*, the first number appearing in May. This journal will contain the same type of articles that formerly appeared in the technical series, and is dedicated to Dr. E. W. Hilgard, the first director of the station.

J. W. Gilmore, head of the division of agronomy, has been granted a six months' leave of absence, beginning July 1, to enable him to make an agricultural survey of the Dominican Republic.

Dr. Jacob Traum, associate professor of veterinary science, was granted leave of absence from April 15 to July 1, as one of a corps of three investigators working under the auspices of the U. S. Department of Agriculture, on a study in Europe of foot-and-mouth disease.

Georgia College.—The week of April 6 was observed as girls' club enrollment week, the membership campaign being conducted by the home demonstration agents. In 1924 the membership was 8,402 and the value of products \$362,827.65, of which \$250,502.97 was from canning clubs and the remainder from the dairy, poultry, millinery, and sewing clubs. As a direct result of the club work in the State, 656 girls are now attending high school and 146 are in college, while 760 have bank accounts.

Illinois University.—The new horse barn, constructed of hollow tile and concrete with steel framework, is nearing completion.

Three new dairy barns, two for cattle and one for calves, and four silos have recently been finished. Vitrified tile has been used for all these buildings. The cattle barns are each 118 by 40 ft. and accommodate 50 and 54 head of cattle, respectively. The calf barn contains 4 bull pens, 8 group calf pens, 12 individual calf stalls, and 15 individual cow stalls.

Kansas College and Station.—In accordance with recent legislation, the University of Kansas, the Kansas State Agricultural College, and the three State teachers' colleges on July 1 pass under the control of a nonsalaried board of regents of nine members, appointed by the governor. The first board comprises 3 members for 1-year terms, 2 for 2 years, 2 for 3 years, and 2 for 4 years, and their successors will regularly be appointed for 4-year terms.

Dr. F. D. Farrell, acting president since March 2, has been appointed president, effective May 5. The degree of doctor of agriculture was conferred

on President Farrell April 15 by the University of Nebraska. The occasion was the commencement exercises of the school of agriculture, at which he delivered the principal address on Law in Agriculture.

N. E. Olson, associate professor of dairy husbandry in charge of dairy manufactures in the college and station, has resigned to enter commercial work, effective June 1.

A conference of branch experiment station workers was held at Manhattan April 13 and 14.

Feeding trials with dairy cattle recently completed show that there is no particular difference in efficiency between corn chop and ground sorgo seed for milk production when fed with a liberal ration of alfalfa hay, grain, and silage, although the ground sorgo seed ration consistently produced somewhat more butterfat than the corn chop ration. Ground kafir was about 97 per cent as efficient as corn chop for milk and butterfat production when fed in a liberal ration of alfalfa hay, grain, and silage. Alfalfa hay was more efficient than sweet clover hay for milk production.

Louisiana University.—Press reports state that Oscar B. Turner, instructor in agronomy, was found murdered in the agronomy building June 7. He had been at the university since 1923 and was 55 years of age. No indication of his assailant has thus far been obtained.

Maryland University and Station.—Director H. J. Patterson has also been appointed dean of the College of Agriculture.

Michigan College and Station.—The name of the college was changed to Michigan State College of Agriculture and Applied Science by an act of the 1925 legislature. The change of name became effective May 13, the seventieth anniversary of the passage of the act establishing the college and of the acquisition of the present college estate, as well as of the sixty-eighth anniversary of the opening of the college. The year 1925 also marks the fortieth anniversary of the inauguration of a course in engineering, the thirtieth anniversary of the establishment of a course in home economics and of the passage of the law establishing a state-wide system of farmers' institutes, and the tenth anniversary of the acceptance of the Smith-Lever Extension Act by the State legislature. During the week of May 11 a series of conferences was held commemorating these dates and calling attention to some of the forward-looking programs of the various divisions of the college.

A total of \$4,063,000 from State sources will be available for maintenance and building work during the next biennium. This amount provides for a \$600,000 chemistry building and a \$250,000 armory, and \$438,000 for permanent improvements. Aside from the mill tax, which returns \$2,000,000 for current maintenance, an additional \$700,000 was appropriated for extension and research. This gives the institution the largest amount of money ever at its disposal.

L. H. Cooledge, research associate in bacteriology since 1912, died May 12, at the age of 37 years. He was a native of South Dakota, graduating from the South Dakota College in 1911 and receiving the M. A. degree from the University of Missouri in 1912. Among his contributions to science was the development of the colorimetric hydrogen-ion method of determining the keeping qualities of dairy products. He was also among the first to study the occurrence of *Bacterium abortum* in the milk of the cow, and he has made numerous contributions on that subject.

Minnesota Station.—Arnold H. Johnson, Ph. D., instructor in agricultural biochemistry, has been appointed assistant chemist in the Montana Station

vice Dr. Paul F. Sharp, who has accepted a position as professor of dairy chemistry in Cornell University.

New Jersey College and Stations.—The State appropriations for the work of the agricultural college and stations show liberal increases in a number of items for the fiscal year 1925-26. An appropriation is made for the development of roads and grounds, \$200,000 is allowed for a new physics building, and a small grant is made for the establishment of a chair in journalism. There is also a special appropriation for remodeling the administration building.

Alvah Peterson, Ph. D., associate professor of entomology and associate entomologist, resigned May 1 to accept a position with the U. S. Department of Agriculture, for the present at the Japanese Beetle Laboratory at Riverton. C. C. Hamilton, associate entomologist at the Maryland Station, was appointed assistant entomologist on the same date.

Cornell University.—The General Education Board has granted the department of rural education of the College of Agriculture \$10,000 a year for five years. Dr. Clyde B. Moore, associate professor of principles of education at the University of Pittsburgh, has been given an appointment in the department under the provisions of the fund.

A child-training department has been organized in the new College of Home Economics under a grant from the Laura Spellman Rockefeller fund. Dr. Nellie Perkins has been appointed head of this department.

Dr. Burt G. Wilder, emeritus professor of neurology and vertebrate zoology, died January 20 at Chestnut Hill, Mass., in his eighty-fourth year. Doctor Wilder was associated with the university from 1868 until his retirement in 1910. During this long period he trained an unusual number of students in physiology, zoology, and related subjects and, at the completion of his first quarter century of service, some of them prepared and published in his honor a volume of original contributions to science. He was also a pioneer in investigating various zoological problems and had published many papers.

Dr. J. R. Schramm, professor of botany, has resigned to become editor of *Biological Abstracts* and has been succeeded by Dr. L. W. Petrie of Syracuse University.

Dr. Emil F. Guba, assistant extension professor of plant pathology, has accepted an appointment as assistant research professor of botany.

New York State Station.—The appointments are noted of Ralph H. Shriner, Ph. D., a graduate student at the University of Illinois, as associate in research (biochemistry), beginning July 1, to fill the vacancy caused by the resignation of Dr. Fred P. Nabenhauer; Carl S. Pederson, a graduate student at the University of Wisconsin, assistant in research (bacteriology), beginning July 1, this being a new position created at the last session of the legislature; and F. L. Gambrell, a graduate student at Ohio State University, assistant in research (entomology), beginning May 1, filling the vacancy caused by the transfer of F. G. Munding to the entomological work of the Hudson River Valley, previously noted. Rodney Cecil of the U. S. D. A. Bureau of Entomology has been assigned to conduct investigations on the Mexican bean beetle in cooperation with the division of entomology of the station.

North Carolina College and Station.—James McDowell has been appointed in charge of research in the textile school. It is planned to make a study of cotton fibers from various parts of the State and elsewhere as to their affinity for bleaching, dyeing, and mercerization, as well as tests of yarns and cloth and of starches, the discovery of new uses for the cotton fiber, the problem of waste as related to imperfect fiber and other factors, and numerous other manufacturing problems.

Press reports announce that Dean and Director B. W. Kilgore has resigned after 30 years' service.

Ohio State University and Station.—The resignation of President W. O. Thompson, effective November 5 when he becomes 70 years of age, has been accepted. He has been appointed president emeritus at his present salary.

The board of control of the station and the trustees of the university have approved an understanding whereby a substation will be established at the College of Agriculture. Members of the college faculty may be appointed to the station staff in the usual way. Such part of their salary as may be agreed upon will be paid by the station, as well as all expenses for the research work done at the college, and the station will be responsible for their work. Under this arrangement the station has appointed Dr. J. I. Falconer head of its newly established department of rural economics.

According to a note in *Science*, Augusto Bonazzi, for many years in charge of soil biological investigations, has accepted the directorship of the Chaparra Sugar Cane Experiment Station in San Manuel, Oriente, Cuba. M. A. Bachtell has been appointed associate in the department of farm management, which has charge of operations on the three district and nine county experiment farms of the State.

Pennsylvania College and Station.—Miss Emma Francis, assistant professor of agriculture and biological chemistry since 1921, died March 4 at the age of 49 years.

The resignations are noted of L. M. Black, P. A. Frost, and N. E. Phillips, assistant professors, respectively, of poultry husbandry, zoology, and entomological extension, and W. A. Kuntz, instructor in botany. George H. Rea has been appointed assistant professor of apicultural extension.

Rhode Island Station.—Basil E. Gilbert, Ph. D., has been appointed chemist.

Texas Station.—J. J. Hunt, wool and mohair specialist in the division of range animal husbandry, resigned March 31 to engage in commercial work, and was succeeded May 1 by Frank Grayson, a practical wool and mohair grader of many years' experience in Rhode Island.

Utah College and Station.—Dr. George R. Hill, jr., has resigned as professor of botany and plant pathology and dean of the school of agriculture to become director of the department of agricultural research of a Utah smelting and refining company.

Wisconsin University and Station.—President E. A. Birge is to retire at the end of the present academic year and will be succeeded by Glenn Frank, editor of the *Century Magazine*.

A bronze tablet, known as the Henry Tablet, has been recently set in a huge boulder at the entrance to the College of Agriculture grounds. The tablet bears the following inscription:

The Henry Quadrangle—In Recognition of the Pioneer Services of Dean William Arnon Henry to the Science and Practice of Agriculture in this University, The State, and The Nation from 1880 to 1907—This Approach to The College of Agriculture Has Been Designated by the Regents The Henry Quadrangle.



EXPERIMENT STATION RECORD

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That science and religion have the common aim of uplifting humanity through the education and development of the individual was aptly illustrated by a meeting to consider agricultural missions, held in this city some months ago as a part of the program of the great Interdenominational Foreign Missions Convention. The first speaker at this meeting was the head of a commission which, in 1920 and 1921, made a first-hand study of education in Africa under the auspices of the Phelps-Stokes Fund and the foreign mission societies of North America and Europe, and in his address he struck the keynote of the session by calling attention to the necessity of improving the economic and living conditions of backward peoples along with or even as a foundation for their religious education. He was followed by several missionaries, who spoke of the extensive work in agricultural education already being carried on at mission stations in various far-away lands, and by representatives of the Federal Department of Agriculture, who discussed a number of specific aspects of this movement, which, despite its comparatively recent origin, is becoming an increasingly important factor in the improvement of the world's agriculture, as well as in the economic and social betterment of the peoples immediately benefited.

The practical applications of agriculture and Christian ethics seem to be nowhere more harmonious than when the two are taught and demonstrated side by side in the mission stations. In most of the foreign mission fields agriculture is usually the principal occupation of the masses, and yet it is more often true than not that their food supply and living conditions are wholly inadequate. In much of Central and South America, for example, the necessity arises of arousing submerged and subjugated races to an interest in raising their standard of living through encouraging the possession of land and training small farmers in improved methods.

Field investigations in representative farming communities of north and central China have shown that from 75 to 95 per cent of the population is engaged in agriculture on a whole-time basis, per-

haps the larger number working as tenants. In the north over 80 per cent of the population realize a yearly income estimated at less than \$150 per family of five persons, which amount is the minimum for subsistence for such a family. The farmer is said to exist mainly by sparing himself all unnecessary exertion from December to March, cutting down drastically on food consumption until spring when work begins again in the fields, and he must labor in an emaciated condition for several weeks before a new supply of food can be obtained. Mission workers, faced with such conditions among the people they desire to serve, find that they must bring about an improvement in their economic welfare, principally by giving attention to the upbuilding of their agriculture and simple industries.

Under the tribal organization of the natives of central Africa, it is the women who sow and care for and harvest the food crops and select and prepare the food; hence, it is the agricultural education of this group that would most directly affect the welfare of the family. Among certain pastoral tribes, however, the men are interested in livestock and take pride in caring for it. With recent developments arising out of British efforts to expand cotton production in central Africa, the men are practically compelled to cultivate a given acreage of cotton as a direct means of paying their taxes or as a money crop. The provision of agricultural instruction by the missions has been of marked assistance to these people. Indeed, the report of the commission already referred to declares that "the services of the missionaries equal and in some respects surpass those of all other groups in the quality of their influence on the African people. . . . The school systems are almost exclusively the result of missionary efforts. . . . They usually represent the ideals of education prevailing in the home country . . . though . . . they are gradually adapting education to the needs of the people." The commission further holds that the best experience in Africa points to the conclusion that, while the education of religious workers and teachers is evidently the first responsibility of secondary schools maintained by the missions, the training of agricultural and industrial leaders is their second duty, and preparation for medicine, theology, engineering, or law their third.

The famine recurrences and dire poverty in India, which is first of all an agricultural country, are well known and, together with the influence of the caste system, give rise to some of the most urgent problems which the missions there must cope with. The instance is cited of the experience of Mr. Sam Higginbottom, an American evangelist now widely known as a pioneer in the agricultural missions field, who upon arrival at his station some years ago was

placed in charge of the leper hospital. In an attempt to secure better living conditions for the patients and keep them from dwelling upon their misfortune, he started them at farm work so that they might provide part of their food and be able to use their Government dole for other purchases. In order to prepare himself for better leadership he returned to the United States for a two-year study of agriculture at the Ohio State University. The ultimate outcome of his effort was the purchase by his board of 275 acres of land and the establishment of the Allahabad Agricultural Institute, now one of the leading specialized agricultural missionary institutions engaged in training teachers and in experimentation.

As a recognized and formally organized phase of foreign missionary endeavor, the agricultural work is a rather recent development and must still be regarded as in the formative period. To be sure, as early as 1876, Dr. W. S. Clark, one of the first presidents of the Massachusetts Agricultural College, established in Japan the Imperial Agricultural College at Sapporo, lecturing on Christian ethics from the Bible in the same classroom where he taught agriculture, but the purpose of his mission and that of his colleagues was primarily educational and not that of evangelization. One of the first men with training in agriculture to go into the foreign field as a missionary seems to have been a Cornell graduate, William C. Bell, although he did not establish a school until 1914. Probably the first of the mission schools to be organized specifically for teaching agriculture was the Thessalonica Agricultural and Industrial Institute, founded in 1903. Agricultural mission work in India was instituted about 1906 by Mr. J. B. Knight, a graduate of the Massachusetts College. In general, however, mission boards have only of late been realizing the importance and opportunity of improving the condition of the natives in this fundamental way.

Since 1912, when Mr. Higginbottom completed his special training and returned to the field to demonstrate the value of his experiment, attention has been definitely directed to the special training of the agricultural missionary and the importance of including an agriculturist on mission staffs. In 1920 the International Association of Agricultural Missions was founded at Amherst, Mass., by a group of returned missionaries who had been in convention at Des Moines, Iowa, in 1919, in order to promote the interests of Christian agricultural work in all lands and expressly to call this field to the attention of the mission boards. The first student conference of the association was held at the Massachusetts Agricultural College, April 8-10, 1921. Among those present was Mr. Higginbottom, who, in emphasizing the demand for trained workers, declared that 99 per cent of the agricultural departments in mission

stations in India had failed because of the tendency to place in charge a theologian who was unfitted by training or inclination for the work.

Within the last few months, an important international project for the scientific improvement of the important food crops of China has been inaugurated by the University of Nanking and Cornell University, with the aid of the International Education Board. Under this plan Dr. H. H. Love of the department of plant breeding in the New York State College of Agriculture left Ithaca in March for China, to devote his sabbatic leave of six months to organizing the work, and beginning in February, 1926, Dr. C. H. Myers of the same department will carry it on for a similar period. It is expected that this procedure will be followed for from five to ten years until a trained staff has been developed at Nanking to take over the work completely.

This program is part of a large scheme for the prevention of famines in China, in which the University of Nanking is doing important work, and it looks to a permanent increase of the food supply by developing better strains of the various food crops. It is expected that as much plant improvement work as the facilities and time will permit will be carried on from the beginning. A general study of the principal food crops in several provinces to determine the best foundation stocks is contemplated.

Under the conditions prevailing, the formal organization of research under missionary auspices can hardly hope for immediate attention in any comprehensive way, and in most institutions provision for it has been more or less incidental and subordinate to that for instruction and demonstration. At the same time, much of the work undertaken is necessarily experimental and consequently contributes to a distinct increase in knowledge. One of the lessons earliest impressed upon the mission workers was the unwisdom of attempting to transplant without sufficient adaptation the farm practice with which they had been familiar. To an exceptional degree, modifications to meet local conditions have been imperative to avoid disaster. This has made essential a study of the situation as it exists, an actual testing out of proposed innovations, and in many cases an enlightened combination of the old and the new. Thus, the task of educating the native peoples has not been entirely one-sided, and the outcome has shown some general as well as many local advantages.

In 1923 a conference was held in Washington, D. C., between representatives of the Federal Department of Agriculture, the Indian Office of the Interior Department, and various missionary boards and agencies. The primary purpose of this conference was to stimulate suggestions as to how agricultural mission schools might encourage investigation of local practices and native products

and the adaptation of improved methods to local conditions, as well as how best to train research workers among native students or staff members. Attention was directed to the work carried on by the Canton Christian College in the way of research for some years with respect to varieties, methods of culture, soil requirements, and means of propagating the lychee, a native fruit similar to the peach, and also with respect to the butter-producing capacity of the water buffalo, the preservation of foods, and improved sericulture. The College of Agriculture and Forestry at Nanking University was also referred to as having rendered valuable service in spreading the practical gospel of reforestation and in making possible actual plantings of considerable size, as well as in numerous lines of agricultural work.

One of the topics of discussion at this conference was the development of exchange relations between institutions such as these and the Department of Agriculture in the introduction of seeds and plants and other ways of mutual helpfulness. That considerable direct service to agricultural science may be derived from such contacts is illustrated by the fact that nearly 500 shipments of seeds and other plant material have been received by the Department from foreign missionaries within the past five years. As earlier instances may be cited the history of the Washington Navel orange, introduced into the United States in 1870 by a missionary at Bahia, Brazil, and the efforts of Dr. W. P. Brooks, for twelve years head of the agricultural college at Sapporo, Japan, in connection with the introduction of the soy bean and other economic plants. Mention should also be made of the valuable assistance which has often been afforded agricultural explorers from this country in remote and unfamiliar regions by mission workers.

At the time of the Washington conference, agriculture was reported to be definitely a part of the teaching program in about 235 mission stations. Of these, 135 were located in Africa, 40 each in China and India, 5 each in Ceylon and Turkey, 4 in South America, and 1 each in Australia, Burma, France, Siam, and the Philippine Islands. Naturally, great variations in scope, in equipment, in background, and in accomplishments exist in the different institutions. In many the agricultural instruction is of the simplest kind, the object being mainly the improvement of the economic status of the people of the region. Others are quite elaborate in organization and equipment, and not a few provide instruction of advanced high school or collegiate grade.

In the more pretentious mission schools, and in some of the more elementary type as well, the operation of large farms by improved

methods is an important feature of the work. Thus, in South America alone, mention may be made of the 3,800-acre farm of the Bunster Agricultural Institute, El Verjel, near Angol, Chile, under Methodist auspices, where students are given practical employment for half a day; the 600-acre property of the Presbyterians at the agricultural high school at Lavras, Minas Geraes, Brazil, in charge of an American who has been engaged in organizing and directing the work since 1907; an English evangelical mission school at Urco, near Calca, Peru; and a tract of land given to the Methodist Board some years ago in Argentina.

As would be expected, demonstration and extension work seems to be quite generally carried on to the full extent that facilities will permit. At the Pinyinana Agricultural School, an American Baptist mission in Burma, where two agriculturally trained men are employed, agricultural extension work, short courses, and conferences are actively conducted. The Salvation Army is interested in a number of farm settlements in India. Gwalior Mission Farm is a Presbyterian settlement for Christian farmers, who are taught improved methods on their own farms.

It is perhaps in Africa that the teaching of practical agriculture has been most extensively developed at the mission stations. Mariannhill Institute, founded 40 years ago by a Trappist monk for native boys and girls in the Province of Natal, is an important center, well known for its intensive industries and agricultural activities. Among these are numerous projects for community betterment, the organization of elementary agricultural instruction, and the preparation of several standard textbooks on agriculture for native schools. At Amanzimtoti Institute, founded in 1848 by the American Zulu Mission, a specialist in agriculture is employed and the erection of an agricultural building is under consideration.

In west-central Africa, Currie Institute under the Canadian and American Congregational Churches renders a unique service, including classroom instruction in agriculture and training on the land in cattle raising, dairying, and the use of farm machinery. Rice and wheat are being extensively cultivated in the lowlands at Kamundongo Station, as well as a mission orange grove.

Extensive and successful farming operations are in progress in the lower Kongo region at the Kisantu Jesuit School, the Kisantu School for Girls under the direction of the Sisters of Notre Dame, and the Tshumbiri Station of the American Baptist Mission Society, while the Disciples of Christ Kongo Mission is preparing to expand its work in agricultural education in the Equatorial district. In Liberia the Lutheran Mission Board has under way considerable agricultural work in the Muhlenberg Mission Boys' School in gardening, cattle raising, and coffee growing. The Kpolopepe School,

75 miles in the interior, offers instruction of elementary grade, with considerable practice work in gardening, the production of bananas and pineapples, and the growing of palm oil trees, and the Bethel Station School gives instruction in four elementary grades with much training in farm work.

Agricultural mission work in the Near East is represented at the International College at Smyrna and the Thessalonica Agricultural and Industrial Institute at Saloniki, already referred to. The latter school, which has now been in operation for nearly a quarter of a century, has aroused considerable interest among the natives in farming by what it has accomplished on what was formerly a barren waste, as well as by the better cattle and other farm animals that have been introduced.

The foregoing summary makes no pretence of completeness, but is intended merely to indicate some typical missionary enterprises. The assembling of comprehensive information for the project as a whole does not seem to have been attempted as yet, and the task obviously presents many difficulties. Not the least of these is the fact that the work is in progress under so many auspices and scattered over so wide a range of comparatively remote territory. There are, however, increasing manifestations of group solidarity, as is shown by the conferences already organized, and in time the community of interest and purpose will doubtless lead to a better acquaintance and closer contacts.

Meanwhile the movement holds much of interest from many viewpoints. It represents pioneer work, a breaking of new ground in a field which fires the imagination. If limited by meager resources to a fraction of the population with whom it is surrounded, it may none the less set in motion a desire for agricultural improvement which may ultimately be carried forward by governmental or other agencies and lead to far-reaching consequences.

Even in its immediate and present-day aspects, the agricultural missionary movement has much of significance and value. It has been largely sponsored and financed in this country, some of its earliest leaders and a large proportion of its active workers have been trained in our colleges of agriculture, and many of its institutions are actively cooperating with agricultural agencies here. These elements alone would give it a direct appeal. For these and many other reasons there will be general good will and genuine interest in the practical attempts being made by the agricultural missionaries to raise the standards of the world's agriculture through the introduction and dissemination of better methods among native peoples and to elevate the living conditions of these peoples by bringing to their doors the best of modern knowledge and experience.

RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Proceedings of the thirty-ninth annual convention of the Association of Official Agricultural Chemists, 1923 (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), Nos. 3, pp. 175-304, pls. 3; 4, pp. 305-443, fig. 1; 8 (1924), Nos. 1, pp. 83, figs. 3; 2, pp. 85-214, figs. 3).—This is the complete report of the convention held at Washington, D. C., November 19-21, 1923 (*E. S. R.*, 50, p. 196). Abstracts of some of the papers presented are given elsewhere in this section. A paper by Pine has been previously noted (*E. S. R.*, 51, p. 713).

Spinacin, a new protein from spinach leaves, A. C. CHIBNALL (*Jour. Biol. Chem.*, 61 (1924), No. 2, pp. 303-308).—With the use of the new method of extracting vacuole and cytoplasmic material from leaf cells (*E. S. R.*, 51, p. 309), the author has isolated from the cytoplasm of spinach leaves a new protein, spinacin, which appears to be present in the cytoplasm as an anion at an H-ion concentration only slightly lower than that of its isoelectric point, which lies between pH 4 and 4.6. The new protein is insoluble in water and salt solution, soluble in excess of either acid or alkali, and is said to contain 16.25 per cent of nitrogen and to be free from carbohydrate.

On analysis by the Van Slyke method the protein, after hydrolysis with 20 per cent hydrochloric acid for 30 hours, showed the following distribution of nitrogen: Amide nitrogen 6.93 per cent, humin nitrogen in acid 0.76, humin nitrogen in lime 1.46, humin nitrogen in amyl alcohol 0.25, cystine 1.27, arginine 13.80, histidine 3.89, lysine 9.63, amino nitrogen in filtrate 58.09, and nonamino nitrogen in filtrate 2.58 per cent.

Note on the basic amino acids yielded by casein, C. S. LEAVENWORTH (*Jour. Biol. Chem.*, 61 (1924), No. 2, pp. 315, 316).—The examination of the filtrate from the lysine picrate in the determination of the basic amino acids in the products of hydrolysis of casein showed the presence of only 3.14 gm. of basic nitrogen, equal to only 1.1 per cent of the total nitrogen of the casein. Since a part of this nitrogen must be ascribed to arginine and histidine whose silver salts are slightly soluble, it is concluded that casein contains no appreciable amounts of any hitherto unrecognized base and that the lysine obtained as picrate represents practically all of the lysine of the casein. This amounted to 5.77 per cent of the casein.

Studies with phytosterols, I-V (*New York State Sta. Tech. Bul.* 108 (1924), pp. 3-40, fig. 1).—The five papers included in this publication are: The Phytosterols of the Endosperm of Corn, by R. J. Anderson (*E. S. R.*, 52, p. 110); and The Phytosterols of Wheat Endosperm, The Separation of Unsaturated from Saturated Sterols, Reduction of Sitosterol—Preparation of Dihydrositosterol or Sitostanol, and Sitosterol, all by R. J. Anderson and F. P. Nabenhauer (and noted below).

The phytosterols of wheat endosperm, R. J. ANDERSON and F. P. NABENHAUER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 7, pp. 1717-1721).—A study

similar to that previously reported for corn endosperm (E. S. R., 52, p. 110) has been made of the phytosterols of wheat endosperm and incidentally of wheat bran, with the following results:

"Wheat endosperm contains at least two different sterols, namely, ordinary sitosterol, $C_{27}H_{45}OH$, and dihydrositosterol, $C_{27}H_{47}OH$, melting point $144-145^{\circ}$ [C.]; $[\alpha]_D^{20} + 25.82^{\circ}$. The dihydrositosterol from wheat bran appears to be identical with the saturated sterol that occurs in corn endosperm. The substance exists throughout the wheat endosperm but the bran is particularly rich in this sterol."

The separation of unsaturated from saturated sterols, R. J. ANDERSON and F. P. NABENHAUER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 8, pp. 1957-1960).—A method is described for the separation of unsaturated sterols from the saturated dihydrositosterol by a modification of the Liebermann-Burchard reaction, essentially as follows:

On treating a chloroform or carbon tetrachloride solution of the mixture of sterols with acetic anhydride and concentrated sulfuric acid, the unsaturated sterol combines with the sulfuric acid to form a stable soluble compound of bluish or purplish-green color which can be removed by the addition of a few drops of water. A saturated sterol is obtained by evaporating the solvent and saponifying and crystallizing the residue from alcohol.

Reduction of sitosterol.—Preparation of dihydrositosterol or sitostanol, R. J. ANDERSON and F. P. NABENHAUER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 8, pp. 1953-1956).—In connection with the isolation of saturated sterols from the endosperm of corn and wheat noted above, the authors have subjected the unsaturated levorotatory sitosterol to reduction with hydrogen in ethereal solution in the presence of platinum black.

The dextrorotatory dihydrositosterol or sitostanol, $C_{27}H_{47}OH$, thus formed appeared to be identical with the dihydrositosterol isolated from corn and wheat endosperm, as shown by the following characteristics: Melting point between 141 and 142° C., specific dextrorotation in chloroform solution $+24.16^{\circ}$, Liebermann-Burchard reaction negative, and Whitby reactions atypical. The substances crystallized in large colorless hexagonal plates containing one molecule of water of crystallization, and the acetyl derivative in large hexagonal plates free from water of crystallization and melting between 138 and 139° .

Sitosterol, R. J. ANDERSON and F. P. NABENHAUER (*Jour. Amer. Chem. Soc.*, 46 (1924), No. 9, pp. 2113-2118, fig. 1).—Preparations of sitosterol obtained from corn gluten, as previously described (E. S. R., 52, p. 110), and from wheat bran and crude corn oil were purified by fractional precipitation of the dibromo-compound from its solution in ether and glacial acetic acid. The purified sitosterol was found to have a higher melting point and higher levorotation than preparations purified by ordinary recrystallization.

It is concluded that "the phytosterol occurring in corn and wheat consists of a mixture of sitosterol and dihydrositosterol. The two compounds occur throughout the grain but the germ contains mostly sitosterol, while the endosperm is richer in dihydrositosterol, and the latter is present in even larger amounts in the bran."

The concentration of vitamin B, P. A. LEVENE and B. J. C. VAN DER HOEVEN (*Jour. Biol. Chem.*, 61 (1924), No. 2, pp. 429-443, figs. 2).—The principle upon which the authors' attempts at concentrating vitamin B were based was the gradual removal of inert material from the Osborne and Wakeman yeast fraction (E. S. R., 42, p. 314).

With Lloyd's reagent the optimal adsorption of the vitamin took place at pH 4, while the optimal extraction from the adsorbed material was at pH 9. By this means a fraction was obtained which was from two to three times as active as the original material. The use of kaolin as adsorbent gave unsatisfactory results. With silica gel better results were obtained than with any other adsorbent. The optimal H-ion concentration for adsorption was at pH 5, while for the subsequent extraction a considerable portion was extracted by acids at pH 3 and a still larger fraction by subsequent extraction with alkalis at pH 9.

Using barium hydroxide as a precipitating agent, as noted in a preliminary report (E. S. R., 51, p. 609), a precipitate was obtained which was eight times as active as the original fraction. By adsorbing on silica gel the solution containing the active material obtained by the barium process and subsequently extracting it at pH 9, material was obtained which was from 200 to 400 times as potent as dried yeast, but this activity was obtained only with a considerable loss of the original material. A better method consisted in suspending the original barium precipitate in water and passing a stream of carbon dioxide through it. Under these conditions most of the potent material remained in the precipitate, while the inert material passed into solution. The precipitate, freed from barium, was active in amounts furnishing about 0.00017 gm. of nitrogen per day, and is to be used as a starting point for further concentration of the vitamin.

The various steps in the procedure as outlined are given in diagrammatic form, with estimates of the activity of the various fractions.

The antiscorbutic fraction of lemon juice, II, S. S. ZILVA (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 632-637).—The author has continued his attempts to isolate vitamin C from lemon juice, and reports that by submitting to further fractionation the active residue obtained in the previous study (E. S. R., 51, p. 503), he has obtained preparations containing only from 0.03 to 0.07 per cent of solids without loss of antiscorbutic activity.

The purest fraction was obtained by first decitrating the lemon juice by a modified method, which is essentially as follows: The juice is treated with an excess of chalk and allowed to remain for from 30 to 60 minutes to deposit salts, after which it is filtered and the filtrate concentrated in vacuo 50° C. to about one-fifth of the original volume. To this is gradually added a volume of alcohol equal to about one-half the original volume of the juice, the inactive precipitate is filtered off and washed with a little alcohol, and the filtrate and washings are distilled in vacuo at 50° to remove the alcohol. The final residue is made up to the original volume.

The decitrated juice as thus prepared is fermented as previously described, concentrated to a small volume, and treated with several volumes of absolute alcohol. The inactive precipitate formed is filtered off and the excess alcohol removed from the active filtrate as before. To the filtrate is added basic lead acetate until no further precipitate is obtained. This is quickly centrifuged, the residue dissolved in acetic acid, magnesium sulfate added to precipitate the lead, and the solution treated with two volumes of absolute alcohol and filtered. The filtrate is finally distilled in vacuo at 50° to remove alcohol and acetic acid and the preparation diluted to the volume of the original juice.

This preparation contained from 0.03 to 0.05 per cent of total solids. An equivalent of 10 cc. yielded only 0.2 cc. N/50 NH_3 by the Kjeldahl method and an equivalent of 100 cc. in two determinations 0.000137 gm. and 0.0000909 gm. of phosphorus. It reduced ammoniacal silver nitrate in the cold and decolorized potassium permanganate. Daily doses of 1.5, 3, and 5 cc. protected guinea pigs from scurvy for 54 days.

The reducing properties of antiscorbutic preparations, S. J. B. CONNELL and S. S. ZILVA (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 638-640).—To determine whether the ability to reduce ammoniacal silver nitrate and decolorize potassium permanganate is an inherent property of the antiscorbutic vitamin, decitrated lemon juice was inactivated by heating in a boiling water bath in an atmosphere of carbon dioxide for 3 hours and in air for 1 and 3 hours, respectively, and also by the action of alkalis as previously described (E. S. R., 49, p. 806). The resulting preparations were tested for the percentage of silver-reducing and permanganate-reducing substances destroyed.

The various treatments had but little effect upon the permanganate-reducing property but a considerable but variable effect on the silver-reducing substance. It is concluded that a part at least, if not all, of the reducing material is chemically independent of the antiscorbutic vitamin.

It is also noted that a repetition of the Bezssonoff test for antiscorbutic vitamin, using the improved reagent (E. S. R., 51, p. 714), gave negative results. "The reaction is therefore useless for the purpose of establishing the presence of the antiscorbutic factor."

The differential dialysis of the antiscorbutic factor, II, S. J. B. CONNELL and S. S. ZILVA (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 641-646, fig. 1).—An extension of previous experiments on the diffusibility of active preparations of vitamin C (E. S. R., 46, p. 11) is reported.

The diffusion of the vitamin as present in decitrated lemon juice was found to take place at a different rate from that of the sugar and nitrogenous substances present. The fact that neither the sugar nor the vitamin diffused through an 87 per cent membrane, while the 88.5 per cent membrane allowed the slow passage of the former but not the latter, is thought to indicate that the dimensions of the vitamin molecule are not far different from those of hexoses.

The vitamin present in swede juice diffused through membrane of the same permeability as when present in lemon juice.

Apparatus with rotating anode for rapid electrolytic analysis [trans. title], L. BERTIAUX (*Ann. Chim. Analyt.*, 2. ser., 6 (1924), No. 9, pp. 257-264, figs. 3).—In the apparatus described and illustrated, the anode and cathode both consist of perforated platinum-iridium cylinders, the larger fixed one serving as the cathode within which the smaller anode revolves, thus keeping the electrolyte in motion. The shape of the electrodes affords a large contact surface.

The analysis of phosphate rock, G. E. F. LUNDELL and J. I. HOFFMAN (*Jour. Assoc. Off. Agr. Chem.*, 8 (1924), No. 2, pp. 184-206).—This paper, which should be consulted in the original, is based upon the study of existing methods and the development of new methods for analyzing phosphate rock in connection with the analysis of the Bureau of Standards standard sample of phosphate rock. A general discussion of methods for the various determinations is first given, followed by the details of the methods finally adopted as most satisfactory. These include methods for the determination of moisture, phosphoric acid, "soluble iron and alumina," and calcium.

A rapid method for the determination of lead and arsenic in lead arsenate, C. C. HEDGES and W. A. STONE (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), No. 4, pp. 321, 322).—The method described combines the tentative sulfate method of determining lead with the Official potassium iodide method of determining arsenic. The lead is determined in the dissolved sample direct, without evaporation, and the arsenic in the filtrate and washings.

A quick method for determining water-soluble arsenic in lead arsenate and zinc arsenite, R. C. ROARK (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), No. 4, pp. 322-327).—Existing methods for determining water-soluble arsenic in lead arsenate and zinc arsenite are reviewed, and a method is described which requires only 5 minutes for the extraction of the arsenic instead of the 24 hours required in the Official method. The technique of the method is as follows:

"Add 2 gm. of dry (or 4 gm. of paste) lead arsenate or 1 gm. of zinc arsenite to 100 cc. of cold water in a 400-cc. beaker, heat to boiling, and continue the boiling 5 minutes. Transfer to a 1-liter volumetric flask, make to volume, shake thoroughly, filter through a dry filter, transfer 250 cc. of the clear filtrate to an Erlenmeyer flask, add 3 cc. of concentrated sulfuric acid, and evaporate on a hot plate. When the volume reaches about 100 cc., add 1 gm. of potassium iodide and continue the boiling until the volume is about 40 cc. Cool, dilute to about 200 cc., and remove the excess iodine with $N/20$ sodium thiosulfate, avoiding the use of starch solution at this point. Neutralize with sodium bicarbonate, add 4-5 gm. in excess, and titrate with standard iodine solution to a permanent blue color, using starch solution as indicator. From the number of cubic centimeters of iodine solution used calculate the percentage of water-soluble arsenic in the sample."

The determination of iodine in food, drink, and excreta, J. F. McCLENDON (*Jour. Biol. Chem.*, 60 (1924), No. 2, pp. 289-299, figs. 2).—Methods of determining iodine in water and organic materials are described in considerable detail.

In the case of water it is often necessary to use at least 100 liters for the determination. This is made alkaline with sodium carbonate, bicarbonate, or hydroxide and evaporated in a large receptacle such as a large dish pan. The dry residue is powdered and placed in a silica or nickel boat, which is then inserted in a long silica combustion tube bent at right angles and leading into a Pyrex tube containing sodium hydroxide. The other end of the combustion tube is provided with a special water-cooled stopper containing a glass tube, through which a stream of oxygen is passed over the sample while it is being heated to dull redness. The ash, together with the evaporated residue from the sodium hydroxide and the rinsings, is extracted with a measured amount of water. A 7.5-cc. aliquot of the filtered extract is neutralized with concentrated hydrochloric acid, made up to a volume of 10 cc., and placed in a separatory funnel with 1 drop of concentrated hydrochloric acid and 1 cc. of purified carbon tetrachloride. If a pink color denoting the presence of iodates appears on shaking, 1 drop of $N/10$ arsenious acid is added, followed after 20 minutes by 1 drop of nitrosyl sulfuric acid. The separatory funnel is shaken vigorously for 2 minutes, after which the carbon tetrachloride is run into a glass-stoppered bottle, centrifuged, and transferred to a microcolorimeter where the amount of dissolved iodine is determined by comparison with a standard solution.

The method for organic materials is the same with the exception of the first ashing process, which is carried out with special precautions, which are described in detail.

It is said to be possible with this method to detect 0.001 mg. of iodine in 1 cc. of carbon tetrachloride and to make a roughly quantitative determination of it in a microcolorimeter.

An improved method for the separation of unsaponifiable matter from fats and oils, R. H. KERR and D. G. SORBER (*Jour. Assoc. Off. Agr. Chem.*, 8 (1924), No. 2, pp. 90, 91).—The method described, the technique of which is given in detail, employs the reverse process of that usually used in the separation of unsaponifiable matter, i. e., after saponification, instead of extracting

the unsaponifiable matter from an aqueous solution of the soap with an immiscible solvent, the soap is mixed with the solvent and extracted from this solution with water. The method is recommended as "a rapid, simple, and convenient method for the determination of unsaponifiable matter in fats and oils."

Determination of fat in cacao products, L. FELDSTEIN (*Jour. Assoc. Off. Agr. Chem.*, 8 (1924), No. 1, p. 75).—To overcome the difficulties in extracting fat from cacao powder due to the clogging of the pores of the filter paper, the author recommends a method of extraction consisting essentially in first digesting the powder on the steam bath with 1:1 hydrochloric acid and then extracting the fat in a Röhrig tube with washed ether, followed by petroleum ether, inverting the tube from 20 to 25 times after adding each solvent, and letting it stand for 30 minutes. The extraction is repeated twice with smaller portions of the solvents, and the combined extracts are evaporated slowly on a steam bath and the fat dried in a boiling water oven to constant weight, dissolved in petroleum ether, and again dried to constant weight.

Analyses of noodles of known composition and estimation of their egg solids content, R. BUCHANAN (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), No. 4, pp. 407-424).—Analyses are reported of a large number of samples of noodles prepared under known conditions from semolina, flour, and a mixture of the two, using whole eggs and egg yolk, dried or frozen and alone or in varying proportions. The determinations included moisture, lipoids, and lipid P_2O_5 by the Rask-Phelps and the Hertwig methods (*E. S. R.*, 51, p. 205), water-soluble nitrogen, and water-soluble protein nitrogen precipitable by 40 per cent alcohol.

The data reported show that with the same egg content the composition of the noodles varies but little whether made from semolina or flour or a mixture of both. The most satisfactory methods for determining egg solids were found to be lipoids, lipid P_2O_5 , total nitrogen, and water-soluble protein nitrogen precipitable by 40 per cent alcohol. The ratios between certain of these substances as proposed by Hertwig distinguished easily whole egg from yolk noodles. The recovery of the lipid P_2O_5 of the ingredients ranged from 81.3 to 104.5 per cent by the Rask-Phelps method and from 80.1 to 105.5 per cent by the Hertwig method. Low results were attributed to decomposition of the lipid P_2O_5 during the time between manufacture and analysis of the noodles.

Losses occurring in samples stored in sealed Mason jars were similar to those occurring in samples stored in paper boxes. It is emphasized that these losses must be taken into consideration in estimating the egg-solids content of noodles which have been stored for some time.

A list of 45 references to the literature is appended.

The lead number of maple products, C. A. CLEMENS (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), No. 4, pp. 350-353).—A comparison of the sulfate method with the chromate, molybdate, and phosphate methods for determining the lead number in maple products is reported.

The molybdate method proved unsatisfactory on account of difficulty in filtering. This was also true of the phosphate method. The presence of potassium acetate interfered with accurate determinations by the sulfate method. The chromate method is recommended as most satisfactory, particularly as not requiring alcohol and, therefore, being more economical.

The lead number of vanilla extracts, C. A. CLEMENS (*Jour. Assoc. Off. Agr. Chem.*, 8 (1924), No. 1, pp. 79-82).—A comparison similar to the above was made of the chromate and sulfate methods for the determination of lead in

the lead number of vanilla extract, together with a comparison of the Official and the Wichmann (E. S. R., 45, p. 718) methods of preparing the solutions.

The Wichmann method was found to give an increase in the lead number of about 50 per cent over the values as determined by the Official method, regardless of whether the lead number was determined by sulfate or chromate. The chromate method gave results agreeing closely with the sulfate method and, as in the case of maple products, is recommended as being accurate, rapid, and economical.

The detection of methyl alcohol in the presence of ethyl alcohol [trans. title], A. KLING and A. LASSIEUR (*Ann. Chim. Analyt.*, 2. ser., 6 (1924), No. 10, pp. 302-305).—The method described is based upon the Denigès test for the detection of methyl alcohol by oxidation with potassium permanganate, and the action of the formaldehyde thus formed on Schiff's reagent. With the technique employed the limit of sensitiveness is about 1 per cent of methyl alcohol.

METEOROLOGY

Report of the chief of the Weather Bureau, 1923-24 (*U. S. Dept. Agr., Weather Bur. Rpt. 1924*, pp. III+271, pls. 7).—This report gives a summary account of the work of the Weather Bureau during the year ended June 30, 1924, and reviews the general weather conditions of the year 1923, with the usual detailed tabulations of meteorological data.

Classification of civilian employees and the program of increased governmental efficiency and economy as they affect the work of the bureau are briefly commented upon. Work briefly noted, having a direct and special bearing on agriculture, included the weekly reports on weather and crop conditions which were resumed during the year, the fruit frost service particularly on the Pacific coast, the beekeepers' service, aid in combating the Mediterranean flour moth in mills, protection of bananas in transit, forest fire weather warnings, and preparation of a revision of the temperature section of the Atlas of American Agriculture. "The publication of the weekly Corn and Wheat Region Bulletin at Chicago, the Cotton Region Bulletin at New Orleans, the weekly weather and crop summaries at the several section centers, and the daily Cotton and Corn and Wheat Region Bulletins at a number of points in the principal agricultural districts, as well as weekly Cattle Region Bulletins for the western grazing section, was continued as in previous years. . . .

"The outstanding features of the weather during the year [1923] were the unusual warmth of January and the last two months; the excessive accumulation of snow and the severe cold over Northeastern States, particularly in New England, during the first three months of the year; the heavy rains during May, September, and October over Oklahoma and portions of adjacent States; and the persistent and large deficiency of rain and snow in California and adjacent areas."

The weather of 1924, A. J. HENRY (*U. S. Mo. Weather Rev.*, 52 (1924), No. 12, p. 588, pls. 2).—Tables show temperature and precipitation departures for the United States for each month and for the year as a whole. The geographic distribution of annual temperature and precipitation departures is charted.

The annual temperature for the country was 0.6° F. below normal. This was "due to the low temperature of the last month of the year and of the last 10 days in that month. Had the computation ended with December 20 the final result would have been a positive departure of at least a whole degree Fahrenheit. . . . In general the spring was cool and wet east of the Rocky

Mountains, the summer was close to the normal, and the autumn on the whole was warm, relatively high temperature continuing well into December." The precipitation departure for the year was -3.7 in. "Notwithstanding the wet weather in Atlantic Coast States in April, May, and September, the year as a whole for the entire area was a dry one. The greatest deficit in rain was felt from the Rocky Mountains to the Pacific, also in a somewhat less degree in the Plains and Gulf States."

The year 1816—the causes of abnormalities, W. I. MILHAM (*U. S. Mo. Weather Rev.*, 52 (1924), No. 12, pp. 563-570).—Possible reasons advanced for the unusual meteorological conditions which prevailed in 1816, "the year without a summer," are the violent volcanic eruption of Tambora in 1815 and a sun spot maximum in 1816. Among the possible causes of abnormality of any month or year are "volcanic eruptions, changes in the activity or condition of the sun (sun spots, solar constant), changes in the surface temperatures of the oceans, changes in the composition of the atmosphere (ozone, carbon dioxide), and accidental causes."

Monthly Weather Review, [November–December, 1924] (*U. S. Mo. Weather Rev.*, 52 (1924), Nos. 11, pp. 521-561, pls. 17, figs. 12; 12, pp. 563-611, pls. 19, figs. 15).—In addition to detailed summaries of meteorological and climatological data and weather conditions for November and December, 1924, and notes, abstracts, and reviews, these numbers contain the following contributions:

No. 11.—**An Analysis of a Retrograde Depression in the Eastern United States of America** (illus.), by J. Bjerknes and M. A. Giblett; **Variation in Solar Radiation Intensities Measured at the Surface of the Earth** (illus.), by H. H. Kimball (see p. 716); **Forty Years' Study of Snow Crystals** (illus.), by W. A. Bentley; **Note on Certain Cloud Forms Observed at Tucson, Ariz.**, August 18, 1924, by A. E. Douglass; **Meetings of the Meteorological Section of the International Geodetic and Geophysical Union, Second General Assembly, Madrid, Spain, October 1-8, 1924**, by H. H. Kimball; **An Approach to Runoff Expectancy** (illus.), by S. L. Moyer; **Comparison of Rain-gage Can and the Horton Snow-board Measurements of Snowfall at Grand Forks, N. Dak.** (illus.), by A. W. Cook; and **Twilight Phenomena on Mont Blanc**, by E. Bauer, A. Danjon, and J. Langevin, trans. by B. M. Varney.

No. 12.—**The Year 1816—the Causes of Abnormalities**, by W. I. Milham (see above); **A New Classification of Typhoons of the Far East** (illus.), by C. Chu; **Dorno on the Technique of the Measurement of Solar Radiation in Restricted Spectral Regions** (illus.), by H. H. Kimball; **The Probabilities of 0.10 Inch, or More, of Rainfall at Springfield, Ill.** (illus.), by W. F. Feldwisch; **Hourly Rainfall at Los Angeles, Calif.** (illus.), by G. M. French; **Diurnal Variations of Precipitation at Honolulu, Hawaii** (illus.), by E. H. Loveridge; **The Glaze Storm of December 17, 1924, in Illinois** (illus.), by C. J. Root; **Sleet and Ice Storm at Corpus Christi, Tex.**, December 19-21 and 25, 1924, by J. P. McAuliffe; **The Squall Cloud in a Thunderstorm: A Direct Observation of Its Motion**, by D. L. Webster; **Temperature of Deep Water**, by W. J. Humphreys; **The Weather of 1924** (illus.), by A. J. Henry (see p. 714); and **Tropical Disturbances during the Hurricane Season of 1924** (illus.), by W. P. Day.

Periodicities, solar and meteorological, C. CHREE (*Quart. Jour. Roy. Met. Soc.* [London], 50 (1924), No. 210, pp. 87-97, fig. 1; *abs. in Sci. Abs., Sect. A—Phys.*, 27 (1924), No. 323, pp. 956, 957; *U. S. Mo. Weather Rev.*, 52 (1924), No. 11, p. 542).—From the study here reported, the author concludes that there is a decided relation between magnetic phenomena and sun spot frequency,

but that this "does not necessarily imply that sun spots themselves are immediately responsible for what happens on the earth. They may be only a symptom of increased solar activity, resulting in increased ionization in the earth's atmosphere."

Variation in solar radiation intensities measured at the surface of the earth, H. H. KIMBALL (*U. S. Mo. Weather Rev.*, 52 (1924), No. 11, pp. 527-529, fig. 1).—This article summarizes observations on duration and character of solar radiation intensity at various stations in different parts of the world over the period 1882-1923, with citations of the sources of the data. The main features of a free-hand curve drawn from the data are great depressions following the volcanic eruptions of Krakatao in 1883; Mont Pelée, Santa Maria, and Colima in 1902; and Katmai in 1912.

The dustfall of February 13, 1923, A. N. WINCHELL and E. R. MILLER (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 9, pp. 443-450, figs. 2).—This paper deals with the third of four dustfalls known to have occurred in this country within the past six years. Descriptions of two of these dustfalls have previously been noted (*E. S. R.*, 40, p. 616; 47, p. 510). "The physical, chemical, mineral, and vegetable composition of the dustfall of February 13, 1923, is discussed in connection with that of other dustfalls of this country and abroad, and tabular analyses are presented. . . .

"The close similarity of composition of atmospheric dust to loess, and the divergence of such dust from other types of soils, suggest very strongly that the two are identical. . . . The fine size of the loess components indicates that they had been carried long distances by the wind, rather than obtained by deflation in the vicinity of deposit.

"The presence of viable spores of plant disease in association with atmospheric dust which has been transported hundreds and even thousands of miles indicates that such diseases may be rapidly spread over longer distances than plant pathologists have hitherto considered possible."

[Meteorological observations at the New Jersey Experiment Stations] (*New Jersey Stas. Rpt. 1923*, pp. 116, 117).—Maximum, minimum, and mean monthly temperatures and daily, monthly, and annual precipitation as compared with the normals are given for the year ended June 30, 1923.

Climatological data for Wyoming, F. E. HEPNER (*Wyoming Sta. Bul.* 139 (1924), pp. 63-160, pls. 2, figs. 11).—This is a revision of Bulletin 100 (*E. S. R.*, 29, p. 812) summarizing observations at Laramie, Wyo., during the 30 years 1891 to 1920 and also at 37 weather bureau stations at other places having records for 10 years or more and fairly representative of meteorological conditions in the State.

Laramie is situated at an elevation of over 7,000 ft. on the eastern edge of a large, nearly level plateau surrounded on three sides by high elevations, which accentuate the prevailing cool, dry conditions and shorten the day from sunrise to sunset about 20 minutes.

The mean annual temperature for the period was 40.7°. The highest temperature recorded at Laramie during the 30 years was 92° F., the lowest -42°. "Only six times in the 30 years has the temperature reached 90°. The sky is nearly always clear and the humidity is low; hence, though the days may be warm, or even hot, the nights are always cool. In other words, the daily range of temperature is great. Another noticeable effect is the great difference in temperature between the sunshine and shade. The winters, while cold, are not excessively so, and, owing to the low humidity, the temperature seldom becomes disagreeable."

The mean annual pressure corrected for temperature but not reduced to sea level was 23.04 in.

The annual precipitation for the 30 years was 10.72 in. "More than 60 per cent of the precipitation comes during the season April 1 to September 1, or what might be called the growing season. The last 10-year period shows an increase of precipitation over the two previous decades but not enough to warrant the assumption that the climate is changing." The mean annual relative humidity was 63.5 per cent. The average number of clear days per year was 188. The prevailing direction of the wind was southwest.

A map prepared by the U. S. Weather Bureau shows the distribution of the average annual rainfall of the State, which varies from 4.48 in. at Hyattville in Big Horn County to 20.61 in. at Alta, Lincoln County.

SOILS—FERTILIZERS

Agrological studies, soil classification, and physical analysis of soils [trans. title], L. A. R. DA SILVA (*Bol. Min. Agr. [Portugal]*, 5 (1922), No. 1-6, pp. [4]+127, figs. 4).—This is the second revised and enlarged edition of this contribution, which deals with the mechanical, physical, and chemical properties of soils and their classification on these bases. Reference is made to methods of studying these properties, particularly those which are intended to evaluate some of the dynamic factors of soils, such as tenacity, adhesion, etc. Tabular data are included, for instance, on the adhesion of soil to iron and wooden surfaces. Other data are included which should be of interest in a study of soil dynamics.

Chemical analysis of soil [trans. title], J. VALMARI (*Acta Forest. Fennica*, 20 (1921-22), pp. 1-67).—The results of chemical analyses of a large number of soil samples are presented and discussed and correlated with types of vegetation growing thereon, special reference being made to the influence of the different plant and chemical factors involved on the availability of soil nutrients and soil reaction.

The sampling of soils, J. O. VEATCH (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 96-98, fig. 1).—Brief information is given on the proper sampling of soils, it being stated that the various layers of the soil profile must be considered in determining the value of the soil.

Soil survey of Choctaw County, Alabama, H. C. SMITH ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1921, pp. III+975-1009, fig. 1, map 1).—This survey, made in cooperation with the Alabama Department of Agriculture and Industries, deals with the soils of an area of 583,680 acres in southwestern Alabama. The county is said to present a wide diversity of topographic features, soil characteristics, and drainage conditions. Physiographically, it consists of the remnants of a southward to southeastward sloping plain so thoroughly dissected that little or none of the original surface is left intact. With the exception of the first and second bottoms every part is well drained, and on the whole the drainage is excessive.

The soils are dominantly light colored, the surface soils being chiefly gray, yellowish gray, and light brown. Most of the soils are deficient in organic matter. Including meadow, 22 soil types of 15 series are mapped, of which the Ruston fine sandy loam, Guin soils, Susquehanna fine sandy loam, and Susquehanna clay cover 15.7, 11.1, 10.7, and 10 per cent of the area, respectively.

Soil survey of Andrew County, Missouri, A. T. SWEET and H. V. JORDAN (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils*, 1921, pp. III+817-850, pls. 4, fig. 1, map 1).—This survey, made in cooperation with the Missouri

Experiment Station, deals with the soils of an area of 278,400 acres included in the Corn Belt region in northwestern Missouri. The greater part of the county is upland, which is nearly level to gently rolling in the northeastern part, undulating to moderately hilly in the central part, and quite hilly in the southwestern part. The uplands are nearly all well drained, and erosion is active over much of the region.

The soils of the county are of loessial, glacial, and alluvial origin, and are predominantly dark in color. They have the texture of silt loams or loams. Including riverwash, 21 soil types of 13 series are mapped, of which the Marshall and Wabash silt loams, Shelby loam, and Grundy silt loam cover 31.3, 15.1, 13, and 11.9 per cent of the area, respectively.

Soil survey of Antelope County, Nebraska, F. A. HAYES ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+757-816, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 552,960 acres lying within the loess hill region of northeastern Nebraska. The topography ranges from almost flat through rolling and steeply rolling to hilly and extremely dissected. The alluvial lands have a generally flat topography. Ample drainage is afforded for most of the country by the Elkhorn River, creeks, and intermittent drainage ways. Surface drainage is not well established in the sandy upland belt throughout the southwestern and north-central parts, but the internal drainage is thorough.

Including dunesand and riverwash, 32 soil types of 14 series are mapped, of which the Valentine sand and loamy sand and Marshall silt loam cover 22.8, 18, and 16.7 per cent of the area, respectively.

Soil survey of Deuel County, Nebraska, L. A. WOLFANGER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+707-755, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 280,960 acres lying in the Great Plains province in western Nebraska. The topography of the county varies from flat on the high table-land and the alluvial valley land to rough and rolling in the slope lands and dunelike in the sandy areas. Drainage is fairly well established except in depressions on the upland and in parts of the flood plains.

The soils are of residual, wind laid, alluvial, and miscellaneous origin. Including dunesand, 28 soil types of 14 series are mapped, of which the Rosebud and Dawes silt loams cover 37.4 and 13.4 per cent of the area, respectively.

Soil survey of Perkins County, Nebraska, L. A. WOLFANGER ET AL. (*U. S. Dept. Agr., Adv. Sheets Field Oper. Bur. Soils, 1921, pp. III+883-928, fig. 1, map 1*).—This survey, made in cooperation with the University of Nebraska, deals with the soils of an area of 567,040 acres lying in the Great Plains region in southwestern Nebraska. The surface is in general nearly flat, but has minor relief features. The county is without well-established drainage. Surface and internal drainage are said to be generally sufficient, however.

Including dunesand, 29 soil types of 10 series are mapped, of which the Dawes and Rosebud loams and dunesand cover 32.2, 17.8, and 14.6 per cent of the area, respectively.

The cultivated soils of the east coast of Sumatra and their fertility [trans. title], F. C. VAN HEUEN (*Proefschr., Tech. Hoogeschool, Delft, 1922, pp. XIV+110, pls. 23*).—This is a survey of the cultivated soils of the east coast of Sumatra. It deals with their physical, mechanical, and chemical characteristics, fertility requirements, and crop adaptations. The prevailing soil types are the upland red soils, the lowland gray-white sandy clay soils, and the so-called tertiary soils. The first two are the most important agriculturally, and are distinguished primarily by their color and elevation.

A summary is given of data relating to the cultivated vegetation of these soils, with special reference to their fertility characteristics. The relation of the fertility of these soils to their volcanic origin, their mineralogical, physical, and chemical composition, and their structure and ground water level is also discussed at some length.

Studies in the soil salt system: A special device for the continuous percolation of solutions through cylindrical masses of soil, R. V. ALLISON (*New Jersey Stat. Rpt. 1923, pp. 231-234, fig. 1*).—This device is illustrated and briefly described.

Tank experiments on soil moisture, D. W. PITTMAN (*Utah Sta. Bul. 192 (1925), p. 25*).—Experiments with alfalfa, corn, wheat, and sugar beets are said to have indicated a maximum yield of all these crops when the soil was maintained at a moisture content of from 20 to 25 per cent of saturation. The greatest efficiency in the use of water closely approximates the point of maximum yield.

[Leaching of heavy clay soils], M. D. THOMAS (*Utah Sta. Bul. 192 (1925), p. 27*).—It has been found that when the salt concentration of heavy clay soils is materially decreased in part of the soil column, the percolate becomes alkaline and the soil column becomes extremely impermeable to water.

Percentage of water freezable in soils, A. M. WINTERMYER (*U. S. Dept. Agr., Public Roads, 5 (1925), No. 12, pp. 5-8, figs. 2*).—Experiments are reported which showed that when water contained in a soil is frozen, such freezing very seldom involves all of the water of the soil. When frozen in a dilatometer the water content can be divided into three volumes determined by the temperature at which they are frozen. The first volume, which is frozen at 0° C., is classified as free water; the second, which freezes at from -4° to -78°, is classified as capillary or adsorbed water; and the third, classified as combined water, is so intimately associated with the soil that it can not be frozen at temperatures below -78°. Different soils varied widely in the percentages of their contained water which fall into these three classes.

Studies of the properties of the soil which affect the percentage of the contained water that may be frozen showed that as a rule the condition of the moisture and the temperature at which it will be frozen depend upon the physical, chemical, and mineralogical composition of the soil. Soluble salts, organic matter, and colloidal material present will remove a certain percentage of the moisture from the free state and prevent its freezing.

The mechanical analysis does not indicate the freezing percentage since it merely shows the size of the soil particles, and the unfrozen water is an index not only of the size of the particles but of other properties as well.

Plowing and cultural tests [at the Utah Station], A. F. BRACKEN (*Utah Sta. Bul. 192 (1925), p. 21*).—It has been found that either fall plowing or plowing done in early spring to a depth of 8 in., followed by enough tillage to keep weed growth down and prepare a good seed bed, is sufficient. Deep plowing, very frequent tillage of fallow, double plowing, and disking preceding plowing are said to be unnecessary.

A test of the time of spring plowing indicates that all spring plowing should be done within a period of two weeks after the season for plowing starts, and that the land which can not be turned in this period should be fall plowed.

Seeding of winter wheat with furrow drill and ordinary drill, A. F. BRACKEN (*Utah Sta. Bul. 192 (1925), p. 23*).—In these tests nitrate accumulation has been directly correlated with the moisture content. Any tillage which tends to conserve moisture, such as fall or early spring plowing followed by normal summer cultivation, is said also to stimulate nitrate formation. Barn-

yard manure added to plats receiving normal tillage stimulates nitrate accumulation.

[Soil microbiological studies at the New Jersey Stations] (*New Jersey Stas. Rpt. 1923, p. 35*).—It is stated that studies on the influence of partial sterilization of soil have shown that this process almost completely destroys the protozoa and fungi and greatly reduces the bacteria, while the Actinomycetes are least affected. The soil organic matter is modified and made more available for the activities of microorganisms, and the partially sterilized soil becomes a better medium for the development of bacteria and certain specific fungi. The Actinomycetes develop only to a limited extent in partially sterilized soil unless a great deal of organic matter is present.

Studies of the thermochemical relationships of the oxidation of sulfur by *Thiobacillus thiooxidans* have shown that about 32 parts of sulfur are oxidized for every unit of carbon assimilated from the carbon dioxide of the atmosphere. However, when conditions are unfavorable for growth, the sulfur-carbon ratio is greatly increased. In studies of the influence of various salts on the growth and respiration of *T. thiooxidans*, nitrates and peptones were found to have an injurious effect on both activities, while sulfates had not. Small amounts of organic substances like dextrose or soil extract may even exert a stimulating effect.

Numbers of microorganisms, nitrifying and carbon-dioxide producing capacity, and soil fertility, S. A. WAKSMAN and R. L. STARKEY (*New Jersey Stas. Rpt. 1923, pp. 230, 231*).—The results of studies of the number of microorganisms and the nitrifying capacity of soils from three different plats are correlated, with crop yields therefrom, to illustrate the work along this line in progress at the station (*E. S. R., 51, p. 624*).

Soil bacteriological studies [trans. title], M. DÜGGELI (*Landw. Jahrb. Schweiz, 38 (1924), No. 2, pp. 203-251*).—A summary is given of the results of a large number of studies begun in 1908 on the activities of soil organisms, particularly nitrogen-fixing organisms, in certain Swiss soils under different methods of fertility treatment.

The results showed that soils fertilized with potash and phosphoric acid, but not with nitrogen, contained a much greater number of nonsymbiotic nitrogen-fixing organisms of aerobic types, such as *Azotobacter chroococcum*, and of anaerobic types, such as *Bacillus amylobacter*, than soils fertilized with sodium nitrate. The latter soils contained the greater number of denitrifying organisms.

Plowing these soils and treating them with liquid cow manure or stable manure increased the numbers of *A. chroococcum*, but plowing seemed to be somewhat injurious to the *B. amylobacter*.

A marked decrease in bacterial numbers in these soils was noted during the period from April to July. This was found to be due not only to a decrease in the amount of available moisture and easily assimilable organic matter, but also to the rapid multiplication of soil protozoa, which was favored by the higher soil temperatures. In fact, the destruction of bacteria by protozoa during this period is considered to be the greatest cause of their rapid decrease in numbers.

Study of anaerobiosis in arable soil [trans. title], S. WINOGRADSKY (*Compt. Rend. Acad. Sci. [Paris], 179 (1924), No. 18, pp. 861-863*).—Studies are briefly reported with *Azotobacter chroococcum* and *Bacillus amylobacter* to show that the activity of these two nitrogen-fixing organisms of aerobic and anaerobic nature, respectively, may be governed by the moisture content of the soil. By use of a suitable nutritive material it was found that when the moisture con-

tent was below a certain point the *A. chroococcum* predominated, but when it exceeded this point and anaerobic conditions prevailed the *B. amylobacter* predominated.

Behavior of bacteria, especially soil bacteria, toward carbon disulfide and the influence of treating soils with carbon disulfide on plant growth [trans. title], A. MAASSEN and H. BEHN (*Arb. Biol. Reichsanst. Land u. Forstw.*, 12 (1924), No. 5, pp. 285-338, fig. 1).—Studies are reported on the influence of carbon disulfide on soil bacteria and on the influence of soil treatment with carbon disulfide on plant growth.

Liquid carbon disulfide was found to reduce markedly the number of bacteria in soils, being the most destructive to the nitrifying bacteria and the least to the denitrifying and putrefactive bacteria. It was as destructive to soil bacteria when dissolved in water as when in vapor form. The vapor form was more destructive to *Azotobacter* than water half saturated with carbon disulfide, but less so than fully saturated water.

Further experiments showed that the treatment of ordinary soils in the field with carbon disulfide generally favored plant growth. This favorable influence was usually also observed in pot experiments. However, soil which had shown increases in yield due to such treatment in the field did not so react when potted. No increase in crop yield resulted from the treatment of sterilized soil with carbon disulfide. There was usually a residual effect of carbon disulfide treatment in field soils, which was noticeable in the second crop, but no such residual effect was observed in pots.

The favorable action of carbon disulfide on the yield of crops and its residual effect were considerably weakened by the addition of organic nitrogenous material, such as bone meal, manure, or moor soil. This was especially true with manure when added some time before the carbon disulfide treatment, and is taken to indicate that the favorable influence of carbon disulfide is not due to an increase in the availability of nitrogenous organic matter.

The yields of crops in soils well supplied with soluble plant nutrients were usually increased by carbon disulfide treatment, although this effect was not observed in sterilized soils aside from a small increase in yield in sterilized but fertilized sand. This is taken to indicate that carbon disulfide exercises a growth-promoting action on crops. However, it is concluded that the favorable residual effect of this substance can not be explained in this manner, but may be due to chemical or biological changes produced. It is also considered possible that the favorable influence of treatment with carbon disulfide is due to partial sterilization of the soil, whereby injurious organisms are killed and organisms tending to increase the supply of available plant nutrients are permitted to multiply in greatly increased numbers.

The continuous growing of wheat and rye, 1922, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt.* 1923, pp. 222-224).—A continuation of studies begun in 1909 (E. S. R., 51, p. 622) indicated that symbiotic nitrogen fixation is more important in maintaining the nitrogen supply of the soil than fixation through the free-living organisms of the soil.

The continuous growing of corn with a legume and nonlegume green manure crop, 1922, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt.* 1923, pp. 224-226).—A continuation of studies to compare a legume and a nonlegume green manure crop and to determine the influence of small applications of manure as a means of introducing organisms in the soil (E. S. R., 51, p. 622) emphasized the value of the legume green manure as a means of furnishing organic matter for the crop and for soil improvement.

The effect in pot culture of green manure in different stages of growth and decomposition, on the subsequent crop, B. L. HARTWELL and F. R.

PEMBER (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 11, pp. 750-753).—The results of studies on the subject at the Rhode Island Experiment Station are briefly reported.

It was found that oats planted at a given time affected the following crops the most favorably if they were turned under when young and subjected to decomposition, whereas their influence was the least advantageous or the most objectionable when they were turned under at the approach of maturity and allowed no opportunity to decompose before the following crop was planted. It was further found that the variation in the effect of green manure, depending on its stage of growth and decomposition, was prevented by the prodigal use of fertilizer during the growth of lettuce.

Action of stable manure on potatoes when applied in different ways [trans. title], D. MEYER (*Deut. Landw. Presse*, 51 (1924), No. 4, pp. 29, 30).—Experiments with potatoes and grain on loess loam soil to determine the influence of time and manner of application of stable manure on its effectiveness as a fertilizer are briefly reported.

The results showed that stable manure placed in the furrows gave better results in the spring than manure plowed under. Also manure spread on plowed ground gave better results in the fall than manure plowed under. The residual action on grain crops of manure applied in the furrows was also greater than that of manure plowed under.

The use of nitrogen in muck fertilization, P. M. HARMER (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 92-96, fig. 1).—Experiments are briefly reported indicating that the value of nitrogen in a fertilizer mixture for muck depends upon the type of muck—that is, whether low or high in lime—and upon the crops to be grown. It is stated that in general the nitrogen content of low-lime muck is from one-half to two-thirds that of high-lime muck.

The influence of varying ratios of phosphoric acid and potash on the yield and on the nitrogen and phosphoric acid content of the crop with different nitrogenous materials, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stas. Rpt.* 1923, pp. 213-222).—Studies on the influence of the phosphoric acid-potash ratio on the availability of nitrogen in sodium nitrate, dried blood, ammonium sulfate, and a combination of these three materials, in a silt loam soil, using barley and sorghum as indicators, are reported.

Nitrogen fertilization distinctly increased the yield of barley grain and straw, sodium nitrate giving the highest yields and highest nitrogen recovery and ammonium sulfate the lowest. Increasing the amount of phosphoric acid from one to two gave increased yields of grain and straw in most cases, but a further increase to three did not materially increase the yields. Varying the amount of phosphoric acid and potash had practically no effect on the percentage of nitrogen and phosphoric acid in the grain and straw.

Some increase in the yield of sorghum was produced by nitrogen fertilization, but increasing the amounts of phosphoric acid and potash fertilization did not consistently increase the yields. A change in the ratio of phosphoric acid and potash did not materially change the percentage of nitrogen and phosphoric acid.

Action of urea as a nitrogenous fertilizer, its influence on soil reaction [trans. title], C. BRIÛUX (*Compt. Rend. Acad. Agr. France*, 10 (1924), No. 31, pp. 898-905; also in *Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 18, pp. 915-917).—Laboratory studies on the rapidity of the transformation of urea in soil and on its influence on soil reaction, and pot and field experiments to compare urea with sodium nitrate as a nitrogenous fertilizer, are reported.

The pot and field experiments showed that the urea gave as good as, and in

some cases better results than, sodium nitrate. Its manner of action was similar to that of ammonium salts, such as the chloride and sulfate. It was further found that urea added to soil imparted an alkaline reaction at first as it was transformed into ammonium carbonate, but as it was nitrified it gradually developed an acid reaction.

Fertilizer experiments with nitrogen on meadow [trans. title], A. ALVES and O. NOLTE (*Mitt. Deut. Landw. Gesell.*, 39 (1924), No. 43, pp. 764-769).—The results of a number of comparative fertilizer experiments with ammonium sulfate and lime nitrogen on meadow are reported and discussed.

The results showed that in general nitrogen fertilization markedly increased the hay yields. The greatest yields were obtained in 21 cases with ammonium sulfate and in 8 cases with lime nitrogen, while in 10 cases there was little difference in the action of the two nitrogenous fertilizers. Owing to the caustic action of lime nitrogen, the best results were obtained by applying it in the fall. Timely rainfall was found to be an important factor in reducing such caustic action. It was found that applications of from 200 to 300 kg. per hectare (178 to 267 lbs. per acre) of ammonium sulfate or of a corresponding amount of lime nitrogen, accompanied by sufficient rainfall, resulted in generally profitable increases in meadow crops.

Effectiveness and profit of nitrogen fertilization of different crops [trans. title], O. NOLTE and R. LEONHARDS (*Mitt. Deut. Landw. Gesell.*, 39 (1924), No. 38, pp. 675-683).—The results of a large number of fertilizer experiments with different forms of nitrogen on winter rye, oats, beets, potatoes, and winter grain are briefly summarized. A striking feature of the results is the fact that in all the experiments, with the exception of that with beets, the greatest relative returns were obtained from the largest applications of nitrogen. This is taken to indicate the danger that where insufficient nitrogen is used it may be unprofitable.

Fertilizer experiments with Rhenania phosphate in comparison with other phosphoric acid fertilizers [trans. title], A. GEHRING and E. POMMER (*Deut. Landw. Presse*, 50 (1923), Nos. 45, p. 376; 46-47, p. 386).—Six fertilizer experiments to compare Rhenania phosphate with superphosphate, Thomas meal, and a so-called colloidal phosphate on barley, potatoes, oats, and rye are reported. In the majority of cases the Rhenania phosphate did not give as good results as Thomas meal, especially on nonacid soils.

The chemico-physical influences of quicklime and calcium carbonates on mineral soils, E. RAMANN (*Soil Sci.*, 18 (1924), No. 5, pp. 387-400).—This is a very technical account of studies on the chemico-physical influences of quicklime and calcium carbonates on mineral soils.

The influence of sodium chloride upon alfalfa grown in solution cultures, S. LOMANITZ (*Soil Sci.*, 18 (1924), No. 5, pp. 353-369, figs. 2).—Studies conducted at the New Jersey Experiment Stations in which a greater range of sodium chloride concentrations than usual was covered and the subject studied more in detail are reported. Alfalfa was grown for 77 days in solutions with amounts of sodium chloride varying from 0 to 0.6 atmosphere osmotic pressure.

An increase in yield was observed in five out of the six cultures containing sodium chloride, the greatest relative increase occurring in the tops. The curve for water absorption followed the direction of the curves for yields of tops and for those of whole plants. Not much variation was noticed in the values for water requirement when whole plant yields were considered. More pronounced differences were found when the values for water requirements of tops were compared. There was an indication that the ratio of root growth to that of tops was greater where the total yield was low than where it was high.

The variations in the nitrogen percentages of the whole plants were not of an order to indicate with certainty any definite relationship between this datum and any of the others studied. The roots from the sodium chloride cultures showed a larger nitrogen percentage than those from the check cultures. The chlorine intake of the plants varied directly with the amount of sodium chloride supplied. This applied to the roots as well as the tops, the roots, however, containing a much smaller percentage.

Inspection of commercial fertilizers for 1924, H. R. KRAYBILL, T. O. SMITH, and S. R. SHIMER (*New Hampshire Sta. Bul. 214* (1924), pp. 19).—Guaranties and actual analyses of 115 samples of fertilizers and fertilizer materials collected for inspection in New Hampshire during 1924 are presented.

Analyses of fertilizers, spring season (supplement), 1924 (*N. C. Dept. Agr. Bul., 1924, Aug., Sup., pp. 16*).—Guaranties, actual analyses, and relative valuations of 287 samples of fertilizer and fertilizer materials collected for inspection in North Carolina during the spring season of 1924 are presented.

Fertilizer report, August 1 to December 31, 1922, J. W. KELLOGG (*Penn. Dept. Agr. Bul. 377* (1923), pp. 55).—Guaranties, actual analyses, and valuations of 644 samples of fertilizers and fertilizer materials, representing 427 brands collected for inspection in Pennsylvania from August 1 to December 31, 1922, are presented.

How is one protected against fraud in the purchase of commercial fertilizers? [trans. title] H. NEUBAUER (*Veröffentl. Landw. Kammer Rheinprov., No. 3* (1924), pp. V+41).—Practical information on the selection and purchase of commercial fertilizers for specific purposes and on how to profit by the results of official inspections is presented for the use of German farmers.

AGRICULTURAL BOTANY

An apparatus used in a study of carbon dioxide evolution from soil supporting plant growth, R. L. STARKEY and J. W. SHIVE (*New Jersey Stas. Rpt. 1923, pp. 241-243, fig. 1*).—A description is given of an apparatus devised by the authors that is said to have proved quite satisfactory for the study of carbon dioxide evolution from soil supporting plant growth.

Influence of soil moisture on the relation between fertilizer treatment and the growth of potatoes, W H. MARTIN and J. W. SHIVE (*New Jersey Stas. Rpt. 1923, pp. 237-240*).—A report is given of experiments conducted with potatoes to determine their water requirement, transpiration, dry weight of tops, and yields when grown with five different percentages of moisture and two rates of fertilizer applications. In every case but one the dry weight of the tops and water loss by transpiration increased with each increase of soil moisture content, and the high fertilizer series required less water to form a gram of dry weight than the low fertilizer series. The highest yields were from the series of cultures with medium moisture content rather than from the highest. The authors point out the importance of considering the relationship of differences of soil moisture to the effect of fertilizers in conducting experiments with fertilizers.

Notes on the influence of sodium chloride on the growth of alfalfa in solution cultures, S. LOMANITZ (*New Jersey Stas. Rpt. 1923, pp. 243-246*).—The results are given of a series of culture experiments with alfalfa grown in Totttingham's solution modified in different series by the addition of sodium chloride and by the elimination of amounts of other salts so that the osmotic concentration of the solutions was retained at the same rates. A considerable increase was noted in the yields of all series receiving sodium chloride except one, and the difference here is considered to be due probably to some other

cause than the addition of salt. The greatest relative increase was in the roots. The nitrogen content of the plants did not differ materially in the different series. Chlorine in the plants increased uniformly with the increased supplies in the solutions. The author found, as had other investigators, that the pH values of the discarded solution showed a gradual approach to neutrality as the period of growth advanced.

Ferric glycerophosphate and soluble ferric phosphate as sources of iron for soybean plants in solution cultures, R. P. MARSH (*New Jersey Stas. Rpt. 1923, pp. 247-252, pl. 1, fig. 1*).—A brief account is given of a study of the influence of small amounts of iron in the forms of ferric glycerophosphate and soluble ferric phosphate upon the growth and appearance of soy bean plants in seven nutrient solutions containing varying partial concentrations of ammonium sulfate.

The data show, with one exception, that the yields of plants grown in cultures receiving ferric glycerophosphate were more than double those receiving the soluble ferric phosphate, and all plants receiving the latter suffered from iron toxicity while those grown in solutions receiving the same concentration of ferric glycerophosphate produced excellent plants. From the author's experiments it appears that ferric glycerophosphate is a form of iron that can be used effectively in culture solutions in which the H-ion concentration is maintained at a relatively high level, and that ferric phosphate may not be used without danger of iron injury except in much lower concentrations than were used.

Both series of plants showed a marked decrease in yield with an increase in the amounts of ammonium sulfate supplied to the solutions. The author claims that by the selection of the proper type of culture solution and the procedure which he followed it is possible to maintain a solution in contact with the roots of vigorously growing plants during their entire growth period without any marked alteration in its pH value from the initial concentration.

Iron solubility tests in culture solutions at different pH values, R. P. MARSH (*New Jersey Stas. Rpt. 1923, pp. 252-255*).—Trottingham and Rankin having shown that the reaction of a culture solution had a marked effect on the solution of iron compounds (E. S. R., 52, p. 123), an experiment was undertaken to determine the solubility of ferric glycerophosphate, soluble ferric phosphate, ferric tartrate, and ferrous sulfate in culture solutions.

The solutions after being adjusted for their pH values received the iron compounds, after which they were allowed to stand in the greenhouse for three days, when the precipitates were collected and analyzed for their iron content. Differences in solubility were observed for the several iron compounds, the solubility being influenced by the type and pH value of the culture solutions. The data presented are considered to suggest in a general way that ferric glycerophosphate could be used to advantage as a source of iron for plants in culture solutions in which the H-ion concentration is maintained at a high level during contact with the plant roots without much danger of iron toxicity, which is quite likely to occur in plants grown in a culture solution of this type when soluble ferric phosphate or ferrous sulfate is used as a source of iron, particularly in culture solutions with pH values approaching the neutral point. It is believed that in solutions of this type ferric tartrate should prove more effective as a source of iron than any of the other compounds considered.

The influence of soluble aluminum salts on the growth of wheat seedlings in Shive's R_2C_3 solution, R. M. BARNETTE (*New Jersey Stas. Rpt. 1923, pp. 255-258*).—The results are given of a study of the influence of aluminum

nitrate, sulfate, and chloride on the growth of wheat seedlings in a culture solution. The seedlings were grown in the solution for a period of three weeks under the influence of varying concentrations of the aluminum salts.

In general, the plants behaved quite similarly under the influence of the different salts used. With a single exception, considering averages alone, 0.1 mg. of aluminum per liter of the culture solution, and all concentrations above this, caused a decrease in the dry weight of all parts of the plant. The increasing concentrations of aluminum added to the culture solutions as soluble salts caused slight but progressive increases in the H-ion concentrations of these solutions due to the hydrolysis of the aluminum salts. It is claimed that under the conditions of the experiment the aluminum ion was distinctly toxic to the growth of wheat at concentration of 0.5 mg. per liter of the culture solution and at all higher concentrations. It is considered significant that the aluminum ion exerts a distinctly toxic action on plant growth, and that little, if any, of the deleterious effect observed can be attributed to the increased H-ion concentration due to the hydrolysis of the aluminum salts.

Notes on the stimulating influence of seed treatment upon the subsequent growth of the plants, D. SILBERT (*New Jersey Stas. Rpt. 1923, pp. 259-262*).—A preliminary report is given of studies on the stimulating influence of seed treatments on the subsequent growth of plants from treated seed. The experiments were conducted with soy beans, Canada field peas, and buckwheat; the stimulants used were the compounds ordinarily used as seed disinfectants, copper sulfate, sodium hypochlorite, mercuric chloride, and formalin. Seed of each kind were soaked for 15 minutes in a definite quantity of solution and afterwards placed on filter paper to remove the film of moisture on the outside. They were then planted in earthenware pots and the plants grown to maturity and the dry weights determined.

From the data presented it is clearly indicated that the dry weight of soy beans was increased in all the treatments except those where mercuric chloride was used at concentrations of 0.05 and 0.15 per cent. The increase in average yields from the seeds treated with formalin and those treated with sodium hypochlorite was not so pronounced as that from seeds treated with copper sulfate. The stimulation resulting from seed treatment was maintained throughout the entire growth period of the plants. Canada field peas in general did not show any increased yields resulting from the seed treatment. With buckwheat the dry weight of the tops was greatest from treated seeds, although the difference in top yield was not particularly pronounced. The yield of seed was consistently superior for the treated seed.

No attempt was made to determine the limits either in concentration of the disinfectants used or the time of seed treatment within which no injurious effects would be observed.

The vitality of buried seeds, W. L. Goss (*Jour. Agr. Research [U. S.], 29 (1924), No. 7, pp. 349-362, pls. 2*).—In continuation of studies on a series of buried seeds (E. S. R., 17, p. 556), a further report is given of the behavior of the seeds of 107 species of plants buried in 1902 and tested at various intervals since that date. In 1923, after having been buried for 20 years, seeds of 51 species grew. Most of them were seeds of common weeds, and it is believed that the seeds of most weeds, when plowed under, will not perish during the period of any normal crop rotation.

Peru as a center of domestication: Tracing the origin of civilization through the domesticated plants, O. F. COOK (*Jour. Heredity, 16 (1925), Nos. 2, pp. 32-46, figs. 10; 3, pp. 94-110, figs. 11*).—This general article, relating to the various plants utilized by the early Peruvian people, contains references to the origin and dissemination of many horticultural plants.

GENETICS

Chromosomal chimeras in the Jimson weed, A. F. BLAKESLEE and J. BELLING (*Science*, 60 (1924), No. 1540, pp. 19, 20).—From a study of a number of aberrant forms of *Datura stramonium*, the authors believe that the evidence already obtained is sufficient to indicate that chromosomal aberrations may be an important cause in the production of bud sports.

Studies of oogenesis in mammals based on investigations with rats and mice [trans. title], J. KREMER (*Arch. Mikros. Anat. u. Entwickl. Mech.*, 102 (1924), No. 1-3, pp. 337-358, figs. 14).—The results of cytological studies of ovarian and tubal eggs of rats and mice are reported from the Anatomical Institute at Bonn. The modern theory of chromosome behavior is mainly verified.

Natural crossings in oats at Akron, Colorado, T. R. STANTON and F. A. COFFMAN (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 10, pp. 646-659).—In an experiment at the Akron (Colo.) Field Station, of the U. S. Department of Agriculture, four varieties of black and four of white oats grown in adjacent head rows crossed naturally to the extent of at least 0.36 per cent of the F_1 progeny of the white oats. The extent of natural crossing seemed to vary in the different varieties and also in different head selections within varieties. The authors suggest that in oats natural crossing may account for some of the variability observed in supposedly pure line varieties, as well as for the frequent occurrence of widely aberrant forms in certain varieties.

Genetic relations of five factor pairs for virescent seedlings in maize, M. DEMEREC (*New York Cornell Sta. Mem.* 84 (1924), pp. 3-38).—A group of corn seedling characters with retarded chlorophyll development is termed "virescent." In the early stage the seedlings are more or less devoid of chlorophyll, which develops later so that the mature plants are normally green. Environment influences appreciably the development of chlorophyll in virescent seedlings, high temperature having a stimulating effect.

Five genetically different virescent types symbolized by V_1v_1 , V_2v_2 , V_3v_3 , V_4v_4 , V_5v_5 were found in the material used in these investigations. Intercrosses showed that none of these is an allelomorph of a mature plant character called fine-striped $F f$, which appears as virescent in the seedling stage. The type V_1v_1 belongs to the $C-Sh-Wx$ linkage group, and the type V_4v_4 is found linked with $Lg lg$ and $B b$, the order of the genes being $C-Sh-Wx-V_1$ and $Lg-B-V_4$, respectively. In each of 14 other linkage tests made between different virescents and other factor pairs, the factors tested were found independent in inheritance. A slight indication of linkage was noticed between V_4v_4 and $D d$.

The inheritance of brown aleurone in maize, P. KVAKAN (*New York Cornell Sta. Mem.* 83 (1924), pp. 22).—Brown aleurone in corn was found to be inherited as a simple dominant, being due to a single factor, $Bn bn$, which is linked with the factor pairs $Gl gl$, glossy seedlings; V_5v_5 , virescent seedlings; and $Ra ra$, ramosa ears. Microscopic, chemical, and genetic studies gave indications that brown aleurone and "pale yellow endosperm" are identical. The pigment of the latter occurs in the aleurone but not in the endosperm. Some differences between the brown or pale yellow pigment of the aleurone, and the common or strong yellow pigment of the endosperm, are discussed.

Inheritance of xantha seedlings in maize, H. TRAJKOVICH (*New York Cornell Sta. Mem.* 82 (1924), pp. 3-13).—Xantha, $Xn xn$, is a chlorophyll character observed in corn seedlings, although under favorable conditions a few plants can be grown to maturity. Xantha seedlings are yellow and have the normal amount of xanthophyll and about 10.7 per cent of the normal amount of chlorophyll. Xantha seedling is determined by a factor or factors

distinct from those controlling virescent and yellow (luteus) seedlings. Xantha seedling seems to be determined by duplicate genes, and possibly one pair of these was present in a homozygous recessive condition in the virescent family used in intercrosses. One of the genes for xantha seedling did not appear to be closely linked with either the gene for virescent seedling or that for endosperm color. A positive correlation was noted between the size of the plastids and the amount of chlorophyll of various seedling types.

Studies on the inheritance of earliness in wheat, V. H. FLORELL (*Jour. Agr. Research* [U. S.], 29 (1924), No. 7, pp. 333-347, figs. 5).—Sunset, an early Australian wheat, and Marquis hard spring wheat, a midseason to late variety when grown in California, and F_1 , F_2 , and F_3 generations of reciprocal hybrids between them were studied in California in endeavors to determine the inheritance of earliness in wheat. The index of earliness used was the date of appearance of the tip of the first spike on the plant.

No data were secured on the F_1 generation. The F_2 population fell into a large early and a small late group in the proportion of 3.07 to 0.93, indicating one allelomorph pair of factors, with possibly a number of minor modifying factors. The recessive late group of F_2 remaining late in F_3 and the fact that over one-half of the F_3 population apparently was homozygous for earliness tended to confirm the presence of only one pair of factors for earliness as contrasted with lateness. Assuming that pure-line rows pass through the heading stage in the same time as pure-line parent varieties, this period may possibly be used to determine progeny rows homozygous for earliness in F_3 and subsequent hybrid generations.

The use of a time-temperature efficiency unit as a method of analysis suggested that while consideration of the time-temperature relation apparently permits a somewhat more accurate analysis of the genetic factors involved in the inheritance of earliness than time alone, more information is evidently needed concerning the response of the wheat plant to temperature and other factors which influence growth.

An experiment in breeding apples, II, R. WELLINGTON (*New York State Sta. Tech. Bul.* 106 (1924), pp. 5-149).—This presentation of data on the fruit and tree characteristics of apple seedlings resulting from 48 F_1 generation crosses, 13 F_1 generation selfs, 1 Baldwin self (?), and 4 crosses between F_1 generation seedlings is a further contribution (*E. S. R.*, 27, p. 843) upon long continued apple breeding investigations.

The probable gametic composition of the varieties used as parents is discussed in connection with an evaluation of the varieties as breeding material. Emphasizing the difficulty of analyzing Mendelian segregation in the apple, a fruit heterozygous for most characters and usually of unknown ancestry, the author states that certain varieties, at least, possess attributes which are sufficiently constant in inheritance to form a basis for predicting breeding results. For example, crosses involving McIntosh may be expected to yield a large proportion of strong, vigorous seedlings. Lack of resistance to certain diseases may be inherited, as shown in the frequent susceptibility of Yellow Transparent seedlings to blight. Red skin color was found to be usually dominant over yellow. Bloom on the fruit and greasy, oily quality of skins were apparently recessive characters, appearing only infrequently. Many characters, such as fruit size and shape, flesh texture and color, and flavor and quality, seemed dependent upon a number of gametes, preventing any definite deductions. Since some acid-fruited parents yielded only acid-fruited seedlings, the author deems it likely that acidity may be a homozygous character in certain varieties. It was a noteworthy fact that crosses involving certain varieties such as Mc-

Intosh, Northern Spy, Yellow Newtown, Delicious, and Yellow Transparent yielded many good quality seedlings, while other crosses involving varieties such as Boiken, Canada Baldwin, and Montgomery were conspicuous for the lack of quality in their progeny. Certain varieties dominated a cross so strongly that many times it was possible to indicate at least one parent by simple examination of the fruit. Of the many varieties utilized in the study, the McIntosh is considered to have been by far the best parent.

A correlation between color of grape leaves at time of foliation and fruit color, F. E. GLADWIN (*New York State Sta. Tech. Bul. 107 (1924)*, pp. 3-8).—Repeated observations on the expanding leaves of a large number of grape varieties showed marked differences in the color of the under surfaces of the first leaves, the colors ranging from pale white, yellow, or creamy, light pink to deep pink and in a few cases crimson and orange. An attempt to correlate these colors with the species' origin failed to yield positive results. However, it was found that white under surfaces were almost invariably correlated with white fruit, or, in other words, the absence of red pigment in the leaves was found to be correlated with the absence of red pigment in the fruit. All efforts to correlate red and black fruits with pinkness of leaves proved inconclusive. In general conclusion, the author points out that the established correlation should be useful in assisting the plant breeder to rogue all white-fruited seedlings from the nursery row and also in assisting the nurseryman in keeping his stocks pure.

Correlation studies on winter fecundity, F. A. HAYS, R. SANBORN, and L. L. JAMES (*Massachusetts Sta. Bul. 220 (1924)*, pp. 43-53).—The authors have calculated the coefficients for expressing the correlation between various factors and the winter egg production of 959 Rhode Island Red pullets hatched in weekly broods from March 25 to June 3, 1923. The correlation coefficients were as follows: Hatching date and weight at 150 days (for the entire flock) -0.3293 ± 0.0194 , hatching date and weight at first egg -0.3807 ± 0.0201 , hatching date and age at first egg -0.1487 ± 0.0228 , hatching date and winter production (for the entire flock) -0.2920 ± 0.0218 , hatching date and winter production (for the genetically early maturing birds alone) -0.4790 ± 0.0254 , age at first egg and winter production (for the entire flock) -0.6061 ± 0.0151 , age at first egg and winter production (first three hatches only) -0.6413 ± 0.0320 , weight at 150 days and winter production (for the entire flock) $+0.2758 \pm 0.0220$, weight at 150 days and winter production (for the hatches of April 15 and 22 only) $+0.2475 \pm 0.0545$, weight at first egg and winter production (for the entire flock) -0.1894 ± 0.0231 , weight at first egg and winter production (for the first eight hatches only) -0.2963 ± 0.0269 , average daily gain, 150 days old to age at first egg, and winter production (for the entire flock) $+0.2899 \pm 0.0220$, average daily gain, 150 days old to age at first egg, and winter production (for the genetically early maturing group alone) $+0.2055 \pm 0.0318$, weight at 150 days and age at first egg -0.2135 ± 0.0221 , weight at first egg and age at first egg $+0.4604 \pm 0.0185$, and average daily gain and number of days, from 150 days old to age at first egg -0.4145 ± 0.0196 .

A genetic linkage between size and color factors in the tomato, E. W. LINDSTROM (*Science*, 60 (1924), No. 1547, pp. 182, 183).—It is claimed that from studies of a large number of crosses involving various sizes and colors of fruit, a definite linkage between these two types of genetic factors was established. Color in tomato fruits is considered to be mainly determined by two different pairs of genes. One pair, *Rr*, controls the red and yellow flesh color, the former being dominant. The other pair, *Yy*, determines skin color, *Y* producing a yellow pigment in the cell walls of the epidermis of the

fruit, and y giving a colorless condition in these cells which is recessive in inheritance. Size of fruit in tomatoes is considered best interpreted by the multiple factor hypothesis.

Reciprocal crosses involving these two pairs of color genes and different sizes of fruit are said to indicate that the color factor pair Yy is closely linked with genetic factors for weight of fruit. It is also noted that red and yellow flesh color, dependent on genes R and r , seem to be independent of weight.

Contribution to the comparative physiology of spermatozoa, II, III [trans. title], E. GELLHORN (*Pflüger's Arch. Physiol.*, 193 (1922), No. 5-6, pp. 555-594, figs. 26).—In continuing this series of studies,¹ two papers are presented.

II. *Further studies on the action of salts.*—The relative effects of the chlorides of various salts and various compounds of sodium on the motility, duration of life, and morphological changes in the spermatozoa of *Rana temporaria*, *R. esculenta*, and guinea pigs have been determined.

III. *Further studies on the action of salts with special reference to mixtures of electrolytes.*—In these investigations it was conclusively demonstrated that in mixtures of electrolytes the toxicity of one tended to neutralize the toxicity of the other toward the activity of spermatozoa of the animals used in the above paper.

Physiological investigations of spermatozoa and ova [trans. title], E. GELLHORN (*Arch. Mikros. Anat. u. Entwickl. Mech.*, 101 (1924), No. 1-3, pp. 437-443, fig. 1).—This is a discussion of the various physicochemical influences affecting the vitality, morphology, and physiology of spermatozoa and ova, based on studies similar to those noted above and with like results.

Investigations of the reciprocal influence of the ovaries and uterus [trans. title], S. TAKAKUSU (*Arch. Mikros. Anat. u. Entwickl. Mech.*, 102 (1924), No. 1-3, pp. 1-50, figs. 34).—In this study, which was conducted at the Kaiser Wilhelm Institute for Biology, the effect of the removal of the uterus of rats on the histological changes in the ovaries and the effect of ovariectomy on the uterus were investigated. The removal of the uterus was found to be almost immediately followed by ovarian changes in which the development of follicles stopped, those present became atresic, and large amounts of lutein tissue developed in the ovary. Some corpora lutea were also present and a few cystic follicles.

Prolonged injections of uterine extracts into hysterectomized females seemed to influence the production of large amounts of fat throughout the ovary. Experiments dealing with the effects of the uterus of one animal on the ovaries of another attached to it further indicated that the secretions of the uterus have a direct effect on the regulation of the normal activity of the ovary. Ovariectomy also was found to reduce the size of the uterus, thus indicating the production of secretions by the ovary which control the function of the uterus.

The follicular hormone of the hen ovary, E. ALLEN, J. W. WHITSETT, J. W. HARDY, and F. L. KNEIBERT (*Abs. in Soc. Expt. Biol. and Med. Proc.*, 21 (1924), No. 8, pp. 500-503).—In testing the action of the follicular hormone of the hen's ovary extracts of small (less than 15 mm. in diameter), medium (15 to 35 mm.), and large (over 35 mm.) follicles were injected into spayed rats for three consecutive doses of 1 cc. at 3- to 4-hour intervals. The occurrence of oestrus in the spayed rats was determined by vaginal smears.

¹ Pflüger's Arch. Physiol., 185 (1920), No. 4-6, pp. 262-280.

Oestrum was noticed in all of the four experiments in which extracts of the small follicles were used and in three of the four in which the extracts of the medium-sized follicles were used, but extracts of full-sized follicles, eggs from the oviduct, fresh eggs (yolks and whites separately), and 5-, 10-, and 14-day embryos with their membranes all gave negative results.

These experiments furnish evidence of the nonspecificity of the follicular hormone in birds and mammals.

Microbic virulence and host susceptibility in paratyphoid-enteritidis infection of white mice.—IV, The effect of selective breeding on host resistance, L. T. WEBSTER (*Jour. Expt. Med.*, 39 (1924), No. 6, pp. 879–886, figs. 5).—In continuing this series of studies (E. S. R., 50, p. 478), it was found that only 42 per cent of the offspring of mice which have survived a lethal dose of mouse typhoid bacilli succumbed to a lethal dose of these bacilli as compared with 72 per cent of the controls. In the second generation from the resistant mice only 15 per cent succumbed as compared with 70 per cent of the controls. A repetition of this experiment gave similar results. Only mice showing no mouse typhoid bacilli in the blood or feces or specific agglutins were used for breeding, thus eliminating the chance of the development of immunity by the young in utero or from the mother's milk. In two experiments offspring of the disease-resistant mice were also found to be more resistant to doses of bichloride of mercury.

"The experiments reported in this paper were performed under conditions which reduced the possibility of specific acquired immunity to a minimum, and indicate, therefore, that in mice host resistance contains important hereditary factors both specific and nonspecific in nature, and that the degree of this resistance in a given population may be enhanced by selective breeding."

FIELD CROPS

The rôle of statistics in agronomic experimentation, H. H. LOVE (*Sci. Agr.*, 5 (1924), No. 3, pp. 84–92).—A discussion of the use of statistical methods in interpreting the results and the planning of agronomic experiments.

Relation of seed size to the yield of small grain crops, T. A. KIESSELBACH (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 10, pp. 670–682, fig. 1).—A summary of all available published field data dealing with the grain yields from seed grades of small grain crops is presented, together with the results of similar work at the Nebraska Experiment Station. See also an earlier note (E. S. R., 38, p. 732).

In the Nebraska experiments wherein hand selected large and small seed representing extreme grades of winter wheat, spring wheat, and oats were compared, small seed yielded 18 per cent less than large when spaced to permit maximum individual plant development, 10 per cent less when equal numbers of seed were sown per acre at an optimum rate for the large seed, and 5 per cent less when equal weights of seed were sown per acre at an optimum rate for the large seed. Unselected seed yielded 4 per cent less than the large when equal numbers were sown per acre, and 1 per cent less when equal weights of seed were sown. Comparison of fanning-mill grades of winter wheat during 17 years showed the heaviest one-fourth to yield 0.3 per cent more, and the lightest one-fourth 2 per cent less than the unselected seed. During 18 years, the heaviest one-fourth of Kherson oats yielded 0.9 per cent more, and the lightest one-fourth yielded 0.7 per cent less than the original unselected seed.

In general, the work at the Nebraska Station seemed to indicate that there will be no material or practical gain in the grain yield, under farm conditions, from the practice of grading seed of small grains which is reasonably free from trash and inert matter.

Some green manures and cover plants, T. H. HOLLAND (*Ceylon Dept. Agr. Leaflet 30 (1924), pp. 6, pls. 7*).—Based on experience at the Peradeniya Experiment Station, information is given concerning the value for green manure and as cover crops of *Erythrina lithosperma*, *Gliricidia maculata*, *Albizzia moluccana*, *Leucaena glauca*, *Adhatoda vasica*, *Tephrosia candida*, *T. hookeriana*, *T. purpurea*, *Crotalaria striata*, *C. usaramoensis*, *C. incana*, *Indigofera arrecta*, *I. hirsuta*, *I. endecaphylla*, *Sesbania aculeata*, *Cassia hirsuta*, *Clitoria cajanifolia*, *Centrosema plumieri*, *C. pubescens*, *Vigna oligosperma*, *Desmodium triflorum*, *Pueraria javanica*, and *Mikania scandens*.

The grasses of Pennsylvania, E. M. GRESS (*Penn. Dept. Agr. Bul. 384 (1924), pp. 245, figs. 235*).—This manual includes descriptions, illustrations, and the known distribution in Pennsylvania for about 250 species and varieties of grasses. In addition to appropriate keys, the work includes discussion of the genetic relationships, classification and characteristics, gross anatomy, uses, and distribution of grasses.

Legume inoculant work (*New Jersey Stas. Rpt. 1923, pp. 141, 142*).—Of nine varieties of soy beans tested, Haberlandt nodulated to a limited extent, Virginia intermediately, and Mammoth Yellow profusely, the difference being attributed to the composition of the internal juices of plants serving as a food and energy source for the organism. The influence of mineral fertilizers on nodulation of soy beans has been described (*E. S. R.*, 52, p. 340) by Perkins. The closer the moisture content of the substratum approached 100 per cent of the water-holding capacity, the greater was the nodulation and the plant growth.

Bacterial counts should evidently be run in connection with hothouse trials to determine the number of viable organisms present and their ability to produce nodules upon the specific host. Tests with diluted cultures demonstrated that a minimum number of bacteria is required to give maximum nodulation, and that this minimum varies widely with the moisture content of the substratum and the presence of energy-giving carbohydrates. The minimum found necessary to give nodulation in the absence of carbohydrates was about 50 bacterial cells per seed.

[Field crops experiments in New Jersey], J. G. LIPMAN, L. G. SCHERMERHORN, and G. W. MUSGRAVE (*New Jersey Stas. Rpt. 1923, pp. 17, 18, 34, 95-100, 153-165, pl. 1, fig. 1*).—Variety trials with oats, corn, wheat, barley, rye, buckwheat, timothy, millets, and soy beans; breeding work with corn and potatoes; seed tests with potatoes; studies of the effect of fertilizers (*E. S. R.*, 51, p. 342) on the yield and shape of sweet potatoes; and trials of kudzu, red clover, and sweet clover are reported on as heretofore (*E. S. R.*, 51, p. 636). Plats treated with sulfur generally produced potatoes yielding somewhat lower but usually freer from scab than those on unsulfured plats.

[Agronomic experiments in Utah], A. F. BRACKEN, G. STEWART, D. W. PITTMAN, A. L. WILSON, and L. M. WINSOR (*Utah Sta. Bul. 192 (1925), pp. 21, 22, 23, 25, 26, 28-30, 40, 53*).—Varietal trials with winter and spring wheat, winter barley, silage corn, potatoes and sweet potatoes, and breeding work with wheat and potatoes are commented on briefly. Alfalfa and rye were the forage crops best adapted to dry land.

Alternate cropping, wheat after fallow, has proved safest under all conditions, the next best method being two crops of wheat followed by a fallow

season. When wheat was plowed under at different stages of growth each successive stage showed decreases in the yields of the following wheat crop. Wheat after peas similarly turned under showed increases in yield up to the bloom stage of the peas. Cultivating wheat grown in rows generally decreased yields. Seeding experiments indicate sowing not less than 5 pk. of good clean winter wheat not later than October 1. Significant differences were not shown between irrigated and dry land seed.

Irrigating the seed bed before planting grain has largely increased total yields as compared with planting under natural conditions and irrigating as usual. Several crops of alfalfa were obtained by early irrigation alone, whereas only one crop was harvested without early water. Fall irrigation has prevented the appearance of burned spots during the following season. Irrigating before planting brought up sugar beets successfully from ground lacking enough moisture. Thinning beets to 12 in. apart, with irrigation soon after thinning, seems to be a desirable practice.

Report of the Dominion cerealist for the year 1923, L. H. NEWMAN (*Canada Expt. Farms, Cereal Div. Rpt. 1923, pp. 20, fig. 1*).—Yields and agronomic data are reported from variety trials in 1923 and during various periods with spring wheat, oats and barley for grain and hay, spring rye, field peas, field beans, and flax and hemp for seed.

Characteristics of clover and alfalfa seed from southern France [trans. title], L. FRANÇOIS (*Ann. Sci. Agron. Franç. et Étrang., 41 (1924), No. 4, pp. 272-282*).—A résumé of the recorded appearances in France of *Trifolium supinum*, an Italian legume, considered with the results of a survey in south-eastern France led the author to conclude that French-grown clover never includes seeds of *T. supinum* among its natural impurities. The presence of seed of *Coronilla scorpioides*, *Helminthia echioides*, *Centaurea solstitialis*, and *Rubus* sp. in clover and alfalfa seed is held indicative of a southern France origin. While *T. stellatum*, *T. angustifolium*, *Bonjeania recta*, *Bromus rubens*, *B. madritensis*, and *Hedypnois polymorpha* may also be indicative, they are not essential to designate a southern France clover or alfalfa if the sample includes among its impurities some seed of *Coronilla scorpioides*, or in its absence, considerable amounts of seed of *Helminthia echioides* and of *Centaurea solstitialis*.

Home-grown vs. foreign red clover seed, L. E. THATCHER (*Ohio Sta. Mo. Bul., 9 (1924), No. 11-12, pp. 187-191, fig. 1*).—Source-of-seed tests with red clover at the station showed seed from Michigan, Germany, and Chile to be most productive in both first and second cuttings. Clover from Italian seed gave the lowest hay yield, was badly affected by anthracnose, and had a considerable weed content. These and previous results and experiments elsewhere (E. S. R., 50, pp. 435, 829) with somewhat similar climatic conditions show that clover seed produced in Ohio, Indiana, Illinois, Michigan, and Wisconsin may be grouped in so far as hardiness and yield are concerned. Red clover seed from this territory should be given first choice for Ohio farms.

Jala maize, J. H. KEMPTON (*Jour. Heredity, 15 (1924), No. 8, pp. 337-344, figs. 6*).—A type of corn cultivated at Jala, about 60 miles southeast of Tepic, Mexico, is characterized by plants averaging 20 ft. in height, ears about 20 in. long and 9 in. in circumference, comparatively heavy kernels ranging from 700 to 1,000 in number, and leaves, tassels, and diameter of the stalks in proportion to the height. The size of this type of corn was shown to be neither the result of a favorable environment nor the result of a doubling in chromosome number. The author thinks that for tropical countries with a long growing season there are possibilities inherent in this variety justifying the careful attention of breeders.

Cotton culture in Argentina [trans. title], N. E. WINTERS (*Min. Agr. [Argentina], Secc. Propaganda e Informes Circ. 320 (1924), pp. 24*).—A practical discussion of the environmental and cultural requirements of the crop with notes on varieties, insect pests, and production costs.

I, Report of three years' cotton improvement work. II, Observations on the behavior of cotton plants, especially during acclimatization, J. B. GRIFFING (*Univ. Nanking, Agr. and Forestry Ser., 1 (1923), No. 6, pp. 45, pls. 6, figs. 3*).—The progress of work with cotton by the University of Nanking involving the acclimatization of American varieties and the improvement of Chinese cotton is reported on, with comment on extension activities, improved implements, cotton insects, and the future of this work in China.

Sample measurements with American varieties, including Trice, Acala, Miller, and College No. 1, have demonstrated the efficacy of roguing and selection in overcoming the degenerative tendencies resulting from change of environment. As judged by lint length, size of seed, and lint index, the quality of the crop at the end of three years' work seemed superior to that of the first year. Fixing of type in superior progenies appeared to be shown by the low coefficient of variability of the above characters in selected progenies. Breaking up of variety type into diverse forms was noted in all imported stocks, even in such pure strains as College No. 1. A strong positive correlation existed between lint index and size of seed, with a moderate negative correlation between percentage and size of seed, whereas no correlation existed between lint length and size of seed.

Inoculation increases yield and quality of peas for canning, A. L. WHITING, E. B. FRED, and J. W. STEVENS (*Wisconsin Sta. Bul. 372 (1925), pp. 23, figs. 19*).—Inoculated canning peas were compared with uninoculated peas on a field scale in most of the pea-growing sections of Wisconsin.

On soils without pea bacteria, inoculated plants through their darker green color and increased height showed greater vigor than uninoculated plants. Bacteria persisting since a previous crop of peas did not suffice to exert the maximum effect, inoculation generally being followed by an increased yield of shelled peas and more vigorous vines with increased protein content. Inoculation seemed quite beneficial in the presence of low temperatures and excess rainfall. Increased percentages of the smaller sizes of peas and improved quality, as shown in tenderness and taste, also followed inoculation. Where some soil inoculation already existed the cultures had little effect in increasing the protein content of the green peas, this effect being much more pronounced when no nodules were present on the uninoculated part of the field.

The influence of plot size and replication on experimental error in field trials with potatoes, K. C. WESTOVER (*West Virginia Sta. Bul. 189 (1924), pp. 32, figs. 11*).—Experiments were made in 1922 and 1923 to determine the size of single-row potato plats and the number of replications needed to reduce experimental error to practical limits.

In field experiments under West Virginia conditions with the Carman No. 3 potato planted 10 to 12 in. apart in rows spaced 3.5 ft. apart, reliable results probably may be expected from the use of a 40-ft. single-row plat replicated 4 times. Under existing conditions, the increased accuracy which might be had by using a single-row potato plat more than 40 ft. long would not offset the added inconveniences. Only plantings of native strains gave significant differences in standard deviation between the 10- and the 20-ft. plats. Strains from other sources (Minnesota and Canada) required greater plat lengths to obtain significant differences. As in similar work with other crops, these studies indicate that there are limits in plat size and in number of replications beyond which no practical reduction in experimental error occurs.

Sorghum [trans. title], L. A. ZHDANOV (*Izv. Opytn. Dona i Sev. Kavkaza* (*Jour. Agr. Research Don and North Caucasus*) No. 3 (1923), pp. 70-83).—Rather extensive trials at the Rostov Experiment Station showed sorghum to be a highly productive grain and forage crop for the arid southeastern regions of Russia, surpassing corn in reliability. The best crops were produced by early varieties.

The influence of lime on the yield and nitrogen content of soy beans, 1922, J. G. LIPMAN and A. W. BLAIR (*New Jersey Stat. Rpt.* 1923, pp. 227-229).—Varieties of soy beans grown on both limed and unlimed plats during the tenth year of this experiment (E. S. R., 51, p. 639) produced respective average yields of 21.2 bu. of beans with 1,856 lbs. of dry stalks per acre and 3 bu. with 334 lbs. The average acre recovery of nitrogen was 92.8 lbs. per acre from the limed and 14.8 lbs. from the unlimed plats. The original nitrogen content of the soil in the limed plats has been practically maintained, whereas the unlimed plats suffered a considerable loss.

Sugar beet fertilization, O. B. PRICE (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 87-89, fig. 1).—Fertilizer trials with sugar beets showed the use of phosphoric acid to give the largest increases in yields, results from potash being more variable, and those from nitrogen carriers depending largely on climatic conditions. Injury due to drilling ammonium sulfate with the seed is illustrated. See also a previous note (E. S. R., 51, p. 38).

The inoculation of sugar beets [trans. title], A. NĚMEC (*Ann. Sci. Agron. Franç. et Étrang.*, 41 (1924), No. 4, pp. 254-259).—Experiments cited showed substantial increases in the yield of sugar beets to follow inoculation with suitable microorganisms.

Studies on fertility of sugar-cane flowers (*Queensland Agr. Jour.*, 22 (1924), No. 3, pp. 248-255, figs. 5).—Observations by W. Cottrell-Dormer and McWalters at the South Johnstone Sugar Experiment Station were concerned with hybridization, ripening of fertile spikelets in the arrows, and seed development and germination, and with the insects attacking the arrows. The fact that many of the spikelets sinking in ether proved fertile gave an index to the possible germination of the seed in an arrow.

Deterioration of Uba sugar cane between cutting and milling [trans. title], L. F. DE FROEBERVILLE (*Rev. Agr. Maurice, Nos.* 13 (1924), pp. 11-18; 14, pp. 74-84).—Experiments in Natal showed a daily loss of weight in stripped cane. Regardless of whether cut or whole, erect or recumbent, sheltered or not, burned cane lost more weight than stripped cane.

The percentage loss of sucrose was lower in the burned cane than in the stripped cane during the first three days, but increased after the fourth day. The purity of sheltered cane, either stripped or burned, declined less than that exposed to the air, although the glucose increased to a greater extent under shelter. The decline in purity seemed less in the basal portions of the cane than in the middle or tops, whatever the length of the section, indicating that deterioration started where the sucrose was least and invert sugar present in the greatest proportion. The greatest amount of sucrose was apparently in that part of the cane where the weight per running foot of cane was heaviest. For the same weight per running foot, the sucrose content appeared greater in burned cane than in stripped cane.

[**Experimental work with sugar cane in Queensland, 1923**], H. T. EASTERBY (*Queensland Bur. Sugar Expt. Stat. Ann. Rpt.*, 23 (1923), pp. 1-46, 52-58).—Besides reporting the progress in 1923 of experiments with sugar cane along the same general lines as noted earlier (E. S. R., 49, p. 828), these pages describe work with bud variations and sports in sugar cane at the South Johnstone Experiment Station and irrigation tests at Home Hill State Farm.

The culture of sugar crops in arid regions [trans. title], N. I. PUSHKAREV (*Izv. Opytn. Dona i Sev. Kavkaza (Jour. Agr. Research Don and North Caucasus) No. 2 (1923), pp. 87-123*).—Field and laboratory experiments with corn, sorgo, and sugar beets grown as sugar plants were carried on at Rostov during the period 1919-1922. Removal of corn ears and sorgo heads in the milk stage increased sugar production in the plants and resulted in a better quality of juice. Sorgo was considered much superior to corn both for sugar and forage. Sugar beets surpassed both corn and sorgo in sugar production, and are thought to be well suited to culture in the rather arid districts of southern Russia if proper methods are followed and economic obstacles overcome.

Growing sweet clover, G. H. CUTLER and G. F. H. BUCKLEY (*Alberta Univ. Col. Agr. Bul. 2 (1923), pp. 24, figs. 5*).—Practices considered suitable for the production and utilization of sweet clover in Alberta are outlined.

Experiments at the University of Alberta indicated that when a nurse crop is not used sweet clover, if well started, can be cut for hay or pastured during the season of planting without materially reducing profitable production the next season. When the crop was cut closely at intervals to simulate pasturing by stock the yield data showed that sweet clover can produce a large amount of pasturage during the season after planting or during the second year. Sweet clover was not as promising for silage as for pasture.

Fertilizer experiments with tobacco, 1919-20-1922-23 [trans. title], A. N. J. BEETS (*Proefstat. Vorstenland. Tabak [Dutch East Indies], Meded. 50 (1924), pp. III+66*).—Fertilizer experiments carried on with tobacco in the Dutch East Indies during the above period showed the value of lime on heavy soils. The use of dessa earth or stable manure favorably influenced acre yields and length and quality of leaves, but these materials are considered potential sources of infection of the soil with *Phytophthora nicotianae*, the cause of lanas disease. Application of ammonium sulfate without manure to tobacco on light soils gave results but little better than those obtained on unfertilized soils. In a dry year differences in length of leaves were not apparent, whether the plants received sodium nitrate or ammonium sulfate. Ureum gave variable results in comparison with ammonium sulfate on light soils. Favorable results followed the application of tobacco seed cake and peanut cake. Bat dung contained so little nitrogen as to be impracticable.

Root development in wheat, R. D. LEES (*Agr. Gaz. N. S. Wales, 35 (1924), No. 9, pp. 609-612*).—When different amounts of superphosphate were applied to wheat at the Wagga Experiment Farm, the superphosphate appeared to increase the depth of root penetration, a plat receiving a dressing of 1 cwt. per acre producing the greatest root development and highest hay yields. While no outstanding differences were noted in the root development of a number of varieties studied, early seeding led to greater root penetration than late seeding.

Report of the experimental work, State testing mill, crop season of 1922, C. H. BAILEY (*Minn. Dept. Agr. Bul. 34 (1924), pp. 29, figs. 7*).—Sixty-one lots of northwestern-grown hard spring wheat were tested during the crop season of 1922. This crop differed markedly from that preceding (E. S. R., 49, p. 831), the kernels being much plumper and heavier, but lower in crude protein and hence in gluten. In general, the spring wheat grown in the western portion of the spring-wheat area was more glutinous than that from the eastern portion.

When groups of samples of straight grade flour were compared, a definite tendency was observed in the direction of larger loaves of bread as the crude protein content increased. Yield of flour increased fairly regularly with in-

creasing weight per bushel. Gains in milling were experienced in grinding average 1922-crop wheat, due to its dry condition.

Ash content of flour was not invariably a criterion of the degree of refinement, particularly when wheats abnormally high or low in ash were milled and when washed and unwashed wheats were compared. Moisture content of the straight grade flour was observed to vary at different seasons, the highest percentages in 1922 and 1923 being encountered in the late spring and late fall. Samples of No. 3 Dark Northern Spring and No. 3 Northern Spring wheat, degraded because of foreign material other than dockage, could generally be cleaned enough before milling so that the resulting flour would be refined and of normal quality. Milling and baking tests with Kota wheat from two points in North Dakota were considered inconclusive.

Results of seed tests for the year ending June 30, 1924, M. G. EASTMAN (*New Hampshire Sta. Bul. 215 (1924), pp. 18*).—The percentage of germination and purity are tabulated for 248 official samples of agricultural seed tested during the year ended June 30, 1924.

Proceedings of the sixteenth annual meeting of the Association of Official Seed Analysts of North America (*Assoc. Off. Seed Anal. North Amer. Proc., 16 [1923], pp. 78, figs. 45*).—A report of the activities of the association during 1923 is given, with the following papers presented at the sixteenth annual meeting at Cincinnati, December 27–30, 1923:

Seventy-five Years of Agricultural Progress, by F. W. Taylor; A Special Form of Delayed Germination in Wheat, by A. M. Lute; Dormancy of Newly Threshed Grain, and Correlation of Laboratory and Field Germination Tests, both by W. O. Whitcomb; The Germination of Vegetable Seeds Sold in Virginia during the Spring Months of 1923, by G. T. French; Observed Variations of Duplicate Germination Tests, by F. S. Holmes; Report on Study of Origin of Alfalfa and Red Clover, by F. H. Hillman; Relation of the Seed Analyst to Uniform Weed Legislation, by A. C. Wilson; The Germination of Cotton Seed, by E. H. Toole (*E. S. R., 52, p. 34*); Studies on Lettuce Seed Germination, by E. F. Hopkins; The Germination of Lettuce Seed, by W. E. Davis; and Study of Influence of Heat and Cold on Germination of Hard Seeds in Alfalfa and Sweet Clover, by J. G. Rodriguez.

Weeds of cranberry bogs, C. S. BECKWITH and J. G. FISKE (*New Jersey Stas. Circ. 171 (1925), pp. 22, figs. 23*).—The more common types of weeds infesting cranberry bogs, which are described with the most effective methods for their control, include cut-grass (*Carex bullata*), reed grass (*Calamovilfa brevipilis*), wool grass (*Scirpus cyperinus*), redroot (*Lachnanthes tinctoria*), double-seeded millet (*Amphicarpon purshii*), green brier (*Smilax* sp.), swamp blackberry (*Rubus hispidus*), bracken (*Anchistea virginica*), cinnamon fern (*Osmunda cinnamomea*), and royal fern (*O. regalis*). Weed control in bogs has resulted in increased yields of cranberries.

HORTICULTURE

[**Horticultural investigations at the New Jersey Stations**] (*New Jersey Stas. Rpt. 1923, pp. 75–95, 101–116, pls. 2, fig. 1*).—In cultural studies with the carnation no differences were found whether the space below the top 4 in. of soil was filled with sand or cinders or simply left an open space. C. H. Connors, working with pure line carnations, reports that apparently fixed white and scarlet types have bred true to the sixth and fourth generations, respectively. In sexual status (*E. S. R., 51, p. 647*), the carnation was found exceedingly variable, ranging from completely staminate to completely pistil-

late plants. Among the 1,200 and odd seedlings grown in the summer of 1923 there were found several very promising individuals. Soil acidity studies with the hydrangea are again reviewed (E. S. R., 52, p. 143). Peach breeding projects were actively pursued, particular attention being paid to crosses between important commercial varieties and some of the station seedlings. Studies of fruit setting in the J. H. Hale variety gave further evidence of male sterility.

Studies conducted by M. A. Blake upon the rate of growth of nursery peach trees showed that at times the Elberta shoots elongate at a rate of more than 1 in. per day. In the case of one station seedling an average height growth of 1.41 in. daily was noted during the period from June 3 to 12. Observations on the roots of peach stocks used in a hardiness test showed marked differences in relation to parentage. The Muir seedlings, for example, were especially vigorous, and had heavy, much-branched root systems. Phenological data upon fruits and ornamentals are presented in tabular form.

Tomato fertilizer studies, reported by L. G. Schermerhorn, show that over a period of three years the highest yield was obtained upon the plat fertilized at the rate of 800 lbs. of acid phosphate, 200 lbs. of potassium chloride, and 100 lbs. of sodium nitrate per acre. In the case of the Bonny Best variety, subjected to 22 fertilizer treatments, the highest yields, based on three years' investigations, were secured from the use of a 6-4-6 mixture. Early Knight cantaloupes started under glass were not only more productive than those sown directly in the field, but were decidedly earlier in ripening, completing their fruiting season the same day that the first fruits were harvested from the field-grown plants. In comparing several fertilizers for cantaloupes, including manure, the maximum yields were obtained on that area where, following the turning under of a crop of rye, there was broadcasted, per acre, 150 lbs. of potassium chloride and 45 lbs. of acid phosphate, supplemented with 250 lbs. of tankage applied in the furrows, and 100 lbs. of sodium nitrate and 100 lbs. of fish meal used as a side dressing. The results of fertilizer studies on 4- and 5-year-old asparagus plantations at New Brunswick are presented in tabular form. A list of vegetable varieties suited to New Jersey is given.

Pomological investigations, reported by A. J. Farley, include the results of a study of the rate of growth of apple fruits of five varieties. It was found that the maximum growth occurred during a brief period succeeding petal fall, and the lowest growth rate during the three weeks preceding maturity. No correlation was noted between the rate of growth and the total weekly rainfall, and no distinct reaction in the rate of growth was observed in response to weekly variations in temperature.

In strawberry investigations preliminary records indicated that in matted row culture, plants spaced 6 and 8 in. apart are more productive than those spaced 3 in. or those allowed to establish themselves naturally. Increased yield is believed to be due to increased size rather than number of fruits.

Considerable time was devoted to further testing of the so-called dry-mix spraying mixture (E. S. R., 49, p. 349). The addition of lime to concentrated lime sulfur used at the recommended strength for summer spraying of apples had no effect whatsoever on spray injury to either fruit or foliage. So far as could be observed, calcium caseinate exerted no influence on the fungus or insect controlling qualities of lime sulfur and lead arsenate summer sprays. Blooming data for peaches, apples, plums, cherries, and pears are presented in tabular form.

[Horticultural investigations at the Utah Station], A. L. WILSON and T. H. ABELL (*Utah Sta. Bul.* 192 (1925), pp. 38-40, 41, 45-47, 48-51).—Onion

variety tests carried on at the Davis County Experimental Farm showed the Valencia type to be significantly the best yielding of the many varieties and strains tried. Attempts to develop a wilt resistant watermelon by crossing with the citron proved unsuccessful, for from 11 original crosses not a single edible melon was obtained in the F_2 generation. Irrigation studies with peas showed in 1923 a distinct advantage in withholding the initial application of water until the plants actually began to show some injury. However, in 1924 exactly the opposite results were secured, indicating that climatic variations play an important rôle. Of 15 cucumber varieties, the Vaughan and the Perfected Davis Perfect proved most satisfactory. Records taken on onions kept in common storage showed the Australian Brown, Valencia, Yellow Globe Danvers, and the Southport Globe to be the best keepers.

Of four methods of planting canning peas, (1) single row, (2) double row, (3) strip, and (4) solid field, tested in an attempt to develop a method which would allow spray rigs to pass without injury to the vines, the fourth method resulted in yields 17.3 per cent above any of the others. Strain tests with the Stone and Greater Baltimore tomatoes showed striking differences in fruit types in stocks obtained from various sources. Crosses between Stone and Earliana yielded seedlings which in nearly all characters resembled the Earliana parent.

Growing and handling asparagus crowns, H. A. JONES and W. W. ROBBINS (*California Sta. Bul.* 381 (1924), pp. 3-34, figs. 15).—This is a combination of careful observations on the development of the young asparagus plant and general cultural information suitable for the practical grower.

The number of seeds to an asparagus berry was found to range from one to eight, with the greatest frequencies at five and six. The fact that asparagus seeds contain a large supply of reserve foods, hemicellulose and fat, enables the germinating plantlet to survive even though deeply planted. Optimum temperature for germination was from 77 to 86° F., and though seeds survived long immersion in water, germination did not result in absence of abundant oxygen. Asparagus seeds absorbed water much more rapidly at temperatures favoring germination than at lower levels. Observations on the first seven shoots developing on young plants showed a gradual increase in length and diameter from the first to the seventh, which was the first to bear blossoms. Male plants bloomed approximately two weeks earlier than did females. The latter, however, were, as a rule, taller and often characterized by fewer shoots. Crowns subjected to desiccation by storage for 53 days in a dry room were slow to develop shoots.

Pollen studies with the pear and the apple [trans. title], F. KOBEL (*Deut. Obst u. Gemüsebau Ztg.*, 71 (1925), Nos. 9, pp. 98-101; 11, pp. 134, 135).—Studies conducted at the Experimental Station at Wädenswil, Switzerland, upon the pollen of 21 pear and 20 apple varieties showed important varietal peculiarities. The viability of pear pollen ranged from 4 per cent for Pastorenbirne to 78 per cent for Vereins-Dechantsbirne, and of apple pollen from 7 per cent for Gravenstein to 98 per cent for Sauergrauech.

Comparing three sugar solutions, namely, 2.5, 10, and 20 per cent, as pollen growing media, it was found that the maximum germinations were quite evenly distributed in the 10 and 20 per cent groups. One pear variety, Fondante Thriot, gave its highest germination in the 2.5 per cent solution. Contrary to the results obtained by Florin (*E. S. R.*, 46, p. 39), the germination differences between the three sugar strengths were for the most part inconsiderable. It is deemed likely that the results were affected by the introduction into each culture of a piece of the pistil of the same variety.

Because of the great variability in the length of the pollen tubes, the author believes that the percentage of viability is probably not a direct measure of fruitfulness. In general, it was found that long, vigorous tubes were associated with uniform, well-filled pollen grains, and that the more uniform the pollen, the greater its viability. Lack of uniformity and low viability of pollen was usually associated with short, thick, and unsymmetrical tubes having the appearance of not being able to traverse the long distance from the stigma to the ovary.

A positive correlation was noted between viability of pollen and the length of the tubes, e. g., apples and pears with 60 per cent germination or above usually developed excellent tubes, while varieties with 30 per cent or less usually produced imperfect tubes. The Bartlett (Williams Christbirne) and the Angoulême (Herzogin von Angoulême) pears and the Jonathan apple were found to be among the good pollen producers, while the Baldwin and Gravenstein apples are listed among the inferior pollen bearers. Unexpectedly, the perry types of pears were usually poor pollen bearers, while cider apples were usually good bearers. It is believed that many of the perry pears produce their fruit parthenocarpically.

Cross-pollination studies with apples confirmed the results of pollen studies, namely, the pollen parents of good pollen-producing qualities tended to produce much higher sets of fruit than did poor pollen bearing parents.

Commercial fertilizers for grapes, N. L. PARTRIDGE (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 98-100).—Working in two Van Buren County Concord vineyards, one located on a naturally fertile loam and the other on a sandy soil of low fertility, the author found that applications of nitrogen-bearing fertilizers were distinctly beneficial to grapes on the poorer soil, but of little value to those on the fertile area. The addition of phosphoric acid, potassium, or both materials in combination to nitrogen did not show any benefit, indicating that nitrogen is the only element likely to prove profitable in vineyards. A comparison of nitrate of soda and ammonium sulfate showed little difference between the two materials.

Concerning the development and present status of grape improvement studies in Prussia [trans. title], J. WORTMANN (*Veröffentl. Preuss. Hauptlandw. Kammer*, No. 7 (1924), pp. 26).—This pamphlet contains a general review of grape breeding and propagation activities, especially as relates to the utilization of American grape species in combating phylloxera.

The biology of the olive [trans. title], J. M. PRIEGO (*Bol. Agr. Téc. y Econ. [Spain]*, 15 (1923), No. 175, pp. 655-665, figs. 9).—A discussion of botanical relationships and habits of flowering, fruiting, and vegetative development, pointing out in conclusion the extraordinary longevity of the olive tree.

Report of the Cranberry Substation [New Jersey], C. S. BECKWITH (*New Jersey Stas. Rpt.* 1923, pp. 299-305).—This is a further report (E. S. R., 51, p. 645) upon the fertility and acidity studies with cranberry soils. Yield records taken on Savannah soils which had received nitrogen in the form of nitrate of soda and dried blood for four consecutive years showed in every case that nitrate of soda had been more effective than dried blood used in equivalent amounts. Acid phosphate was apparently superior to rock phosphate, but since a combination of the two was even more effective than either one, no definite conclusions are drawn. In a quantitative test with mixed fertilizer, consisting of 75 lbs. of nitrate of soda, 75 lbs. of dried blood, 300 lbs. of rock phosphate, and 50 lbs. of sulfate of potash, 800 lbs. per acre was again the most satisfactory quantity. On muck soils rock phosphate supplemented with acid phosphate proved beneficial in increasing yields. On the other hand, on

new muck soils fertilizers of any nature apparently exerted a deleterious effect.

Records covering five years of soil acidity studies, both on the Savannah and the muck soil types, continued in general to show that lime, either in the form of high calcium or magnesium limestone, increases yields.

Outdoor flowering annuals, P. KACHE and C. SCHNEIDER (*Einjahrsblumen. Berlin: Gartenschönheit, 1924, pp. 171, pls. 12, figs. 116*).—Illustrated in part in color, this handbook is devoted to the description, planting, culture, and utilization of outdoor flowering annuals.

The culture of perennials, D. M-P. CLOUD (*New York: Dodd, Mead & Co., 1925, pp. XIII+271, pls. 16*).—A presentation of popular information concerning the planting and care of perennial flower gardens, and the propagation and utilization of perennial plants.

Irises for the beginner, edited by R. S. SURTEVANT (*Amer. Iris Soc. [Bul.] 10 (1924), pp. 59, figs. 23*).—This pamphlet contains several brief articles relating to the botany of the iris, its culture and hybridization, and the production of new varieties from seed.

How to grow roses, R. PYLE (*West Grove, Pa.: Conard-Pyle Co., 1925, 16 ed., rev., pp. 189, pls. 16, figs. 111*).—This illustrated handbook on the rose is a revised edition of the work previously noted (E. S. R., 50, p. 645).

Roses in the garden, C. H. CONNORS (*New Jersey Stas. Circ. 172 (1924), pp. 27, figs. 14*).—Abundantly illustrated, this pamphlet contains general information on rose growing, types and varieties, soils and soil preparation, culture, pruning, protection from various pests and from winter cold, etc.

The book of water gardening, P. BISSET (*New York: A. T. De La Mare Co., Inc., 1924, 2. ed., rev., pp. 205, pls. 3, figs. 126*).—This elaborately illustrated book, containing general information concerning the arrangement and culture of aquatic and moisture-loving plants, pays especial attention to the water lilies.

Garden improvement, T. G. W. HENSLOW (*London: Dean & Son, Ltd.; New York: Brentano's, 1924, pp. XXII+368, pls. 160, figs. 16*).—This is a general treatise on gardening, discussing such matters as equipment, planning, and planting; plant materials and their utilization; protection from insects, etc.

The horticultural exhibitor: A guide to success, A. J. MACSELF (*London: Thornton Butterworth, Ltd., 1924, pp. 222, pls. 8, figs. 26*).—Information is presented concerning the choice of plant materials for exhibition purposes, methods of culture and display, etc.

FORESTRY

Hemlock: Its place in the silviculture of the southern New England forest, P. H. MERRILL and R. C. HAWLEY (*Yale Univ. School Forestry Bul. 12 (1924), pp. 68, pls. 6, figs. 2*).—A report upon studies begun in 1923 to determine the rate of growth and the principal silvicultural requirements of the hemlock, a comparatively neglected species in southern New England. Evidence was obtained to indicate that hemlock is a constant element of the climax forest on the upper soils of southern New England and contiguous areas, its frequent absence being due to its extreme susceptibility to fire injury in the seedling stages, and also to its inability to sprout from the stump. Because of an unusual tolerance to shade, hemlock is deemed an excellent tree for understory growth in hardwood forests. Furthermore, the wood has considerable value as lumber, railroad ties, poles, charcoal, and fuel.

Log rules and volume and yield tables computed from actual measurements showed that, in general, hemlock occupies an intermediary position between the oak and the white pine, estimates indicating that hemlock stands will

produce on rotations under 60 years 50 per cent, and over 60 years 60 per cent of the yield of white pine. In the region considered in this study, hemlock reproduces naturally, whereas white pine must be introduced artificially and maintained against hardwood competition. Since hemlock liberated from a hardwood cover was found to grow almost 2.5 times as rapidly as before releasing, it is suggested that mixed stands may be gradually converted to pure hemlock by repeated thinnings of the hardwoods. In order to insure regeneration following clear cutting operations, a few hemlocks should be left as seed trees, fires excluded, and grazing allowed for the purpose of suppressing hardwoods.

In the form of an appendix there are presented the data and methods used in the computation of the various tables, those for taper values being prepared under the supervision of C. E. Behre, of the recently established Northeastern Forest Experiment Station. Height measurements of seedling hemlocks ranging from 1 to 10 years in age were, respectively, 0.1, 0.2, 0.3, 0.6, 0.8, 1.25, 1.8, 2.7, 3.9, and 5.2 ft.

Cultivation of forest plantations, A. K. CHITTENDEN (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 112, 113).—Norway spruce planted in a carefully prepared and manured soil, tilled four times each year succeeding planting, showed at the end of the fourth season 59 per cent greater height growth than did similar trees planted in a heavy June grass sod.

Growth of Eucalyptus in California plantations, W. METCALF (*California Sta. Bul.* 380 (1924), pp. 61, figs. 28).—Of the many species of Eucalyptus introduced into California, only four, namely, the blue, gray, red, and sugar gums, have been used to any extent in establishing plantations. Records taken in 67 widely distributed groves of blue gum showed that this species is capable of making very rapid growth on favorable sites, figures for an 8-year-old plantation on a very fertile and moist silt loam in Alameda County showing a mean annual growth increment of 8.17 cords per acre. The average of the 67 groves was 3.02 cords per acre. Red and gray gums yielded an average of approximately 1 cord per acre per year, but were found more resistant to drought than the blue gum and more durable as posts set in moist soil. The sugar gum, very drought resistant but easily injured by frost, made an average annual growth of 1.22 cords per acre based on 17 groves. Various less important species are discussed, and notes are given on the utilization of the Eucalyptus wood, the chief uses being as fuel, charcoal, and in the manufacture of small turned articles. Appended are data on the methods employed in taking the field measurements, in classifying sites, and in the establishment of Eucalyptus plantations from seed.

Key to the eucalypts of Western Australia, S. L. KESSELL and C. A. GARDNER (*West. Aust. Forests Dept. Bul.* 34 (1924), pp. 128, figs. 38).—This pamphlet, containing descriptive and botanical notes concerning all the arborescent species of Eucalyptus known to be indigenous to Western Australia, constitutes a key to the genus.

Some New Zealand woods, G. A. GARRATT (*New Zeal. State Forest Serv. Prof. Paper* 1 (1924), pp. 56).—A presentation of data obtained as a result of a macroscopic and microscopic study of the secondary wood of 10 gymnosperms and 18 dicotyledons, with keys to the identification of the latter.

Turpentining studies in Greece [trans. title], A. OEKONOMOPOULOS (*Centbl. Gesam. Forstw.*, 48 (1922), No. 3-6, pp. 85-109, figs. 9).—An extended article dealing with the results of investigations of the various methods of tapping technique.

Report of the Royal Commission on Pulpwood, Canada, J. PICARD ET AL. (*Ottawa: Govt., 1924, pp. 292, figs. 12*).—Herein are presented the results of an inquiry upon the pulp wood resources of Canada, especially in relation to the advisability of restricting exports.

The hundred and second report of the commissioners of His Majesty's woods, forests, and land revenues, N. BUXTON and G. G. L. GOWER (*[Gt. Brit.] Commrs. Woods, Forests, and Land Rev. Rpt., 102 (1924) pp. 50*).—The usual annual statement (E. S. R., 50, p. 544), consisting for the most part of tabulated statistics concerning finances, accessions, leases, etc.

[Annual report of the New Zealand State Forest Service, 1924], L. M. ELLIS ET AL. (*New Zeal. State Forest Serv. Rpt. 1924, pp. 29, pls. 3, figs. 10*).—The usual annual statement (E. S. R., 50, p. 545).

DISEASES OF PLANTS

Report of the department of plant pathology, W. H. MARTIN ET AL. (*New Jersey Stas. Rpt. 1923, pp. 341-414, pls. 3*).—A list is given of the more important plant diseases observed during the year, followed by progress reports on some of the major investigations that were carried on during the period covered by the report.

Spindle tuber, a disease of potatoes, W. H. Martin (pp. 345-347).—In the fall of 1921 the author's attention was called to a condition shown by late-planted Irish Cobbler potatoes grown for seed purposes, the vines being smaller and more upright and many of the tubers being elongated. At digging time normal tubers and elongated ones were selected and stored for planting in the spring of 1922. After planting under identical conditions the sprouts from the elongated tubers were spindling, of unusual color, and less vigorous. The yields of tubers from the round potatoes were about double those from the elongated ones, the striking difference being a large increase in yield of first-class tubers and the reduced numbers of seconds and culls from the round tubers. This disease is said to be confined in New Jersey to this one variety, and the author suggests the rejection from the seed plats of all plants producing long tubers.

The use of sulfur for the control of potato scab—1922 results, W. H. Martin (pp. 348-355).—The results are given of cooperative experiments with inoculated and uninoculated sulfur for the control of potato scab. Inoculated sulfur is said to have given the greatest percentage of clean tubers, and on light soils applications of 300 lbs. of inoculated sulfur per acre gave as satisfactory control as applications of 600 lbs. The pH reaction of the soil was reduced about as much by the smaller treatment as by the larger one. In tests of fertilizer ingredients on scab development ammonium sulfate was found to reduce and nitrate of soda to increase the amount of scab. Disinfecting the seed tubers is recommended, whether planted on clean or infected soil, although applications of sulfur will reduce the severity of attack regardless of condition of seed or soil.

Potato spraying and dusting tests in 1922, W. H. Martin (pp. 356-364).—Experiments with Bordeaux mixture and dust applications for the control of foliage diseases of potatoes are said to indicate the superiority of Bordeaux mixture over dust treatments and that homemade Bordeaux mixture prepared with stone lime was better than any of the commercial preparations or where hydrated lime was used. The results were especially marked where late blight was present.

Peach wilt, C. M. Haenseler (pp. 364-366).—A wilt of peach twigs is described, and in his studies the author isolated a form of *Verticillium* from

wilted twigs that was morphologically identical with *V. albo-atrum*. Attempts to reproduce the disease by inoculating with the organism gave negative results. The presence of the organism in the wilted twigs is believed to be associated with winter injury.

Pea root rot investigation, C. M. Haenseler (pp. 366-375).—Pea root rot is said to be widely spread in New Jersey. *Rhizoctonia solani*, two species of *Fusarium*, and a sterile fungus were isolated from diseased roots, and the disease was produced under greenhouse conditions. The species of *Fusarium* and the sterile fungus produced symptoms indistinguishable from those shown by diseased field grown plants. The author claims that the *Rhizoctonia* is least parasitic at soil moistures most favorable for the growth of the pea, while the sterile fungus is least parasitic in extremely dry soils or at a moisture content favorable for pea growth. The *Rhizoctonia* was found to attack peas at any time, but the plants were most susceptible during the germination period.

Tomato disease investigations, R. F. Poole (pp. 376-386).—Spraying and dusting experiments for the control of *Septoria lycopersici* and *Macrosporium solani*, as well as some other diseases, are reported. The most efficient control followed five sprayings with Bordeaux mixture to which fish oil soap was added. Copper lime dusts gave slightly increased yields, but the yields were not comparable with those obtained with Bordeaux mixture. Experiments with fertilizers are said to indicate that leaf spot can not be economically controlled by limiting the application of fertilizers. Streak, filiform, and mosaic diseases of tomatoes are reported as serious in some places in the greenhouse culture of this crop. Heavy applications of Bordeaux mixture did not control streak, nor did soil conditions appear to be a limiting factor in its occurrence.

Some results obtained in the investigation of the control [of diseases] of sweet potatoes, R. F. Poole (pp. 387-404).—Comparisons were made of inoculated and uninoculated sulfur, and studies were carried on on variety resistance to scurf of sweet potatoes due to *Monilochaetes infusans*. Sulfur at all the rates used reduced scurf, inoculated sulfur proving best in most of the experiments. In some cases a red pigmentation of the roots was observed following the use of uninoculated sulfur. Considerable variation in susceptibility to scurf was shown by the varieties tested. For the control of sweet potato pox sulfur again reduced the percentage of disease present. The residual effect of lime applied in 1921 resulted in an increase of pox, while sulfur applied at the same time reduced pox infection and increased yield.

Stem rot or wilt caused by *Fusarium batatatis* and *F. hyperoxysporum* is said to be serious in the State, and the most satisfactory measures for control appear to be the development of resistant varieties. Some observations are reported on the relation of stem rot infected roots to the production of diseased sprouts.

Corn root and ear rot studies, W. D. Moore (pp. 404-407).—According to the author, the testing of seed corn will reduce the amount of disease, but will not give complete control, due probably to heavy soil infestation. Alkaline soils were found to favor root rot, and flinty types of corn appeared to be more resistant than other varieties tested.

Spraying tests for the control of apple blotch, G. W. Fant (pp. 408, 409).—Spraying with lime sulfur reduced but did not entirely control blotch. The author recommends that where blotch appears late in the season accessory sprays in addition to the regular schedule may prove valuable. It is believed that accessory sprays may be discarded in orchards that have been regularly sprayed for several seasons, as twig cankers as a source of infection would be eliminated.

Seed potato disinfection studies, E. S. Clark (pp. 410-414).—Hot and cold formaldehyde, mercuric chloride, and some of the new mercuric compounds were tested for the control of Rhizoctonia, the effect on the sclerotia being noted. Corrosive sublimate 1-1,000 gave good control, but the 1-240 formaldehyde solution did not destroy the sclerotia. Prolonging the time of treatment did not appreciably increase control. Heating to 120° F. increased the efficiency of the treatments, although again formaldehyde was less satisfactory than corrosive sublimate. Semesan and Kalimat were tested, and neither proved as efficient as corrosive sublimate solution in destroying the sclerotia.

Plant pathology, B. L. RICHARDS (*Utah Sta. Bul.* 192 (1925), pp. 58-61).—A report is given of the investigations of mosaic and leaf roll diseases of potatoes. The symptomology of the two diseases was determined for the principal potato varieties known commercially in the State. It was found that the degree of isolation generally recommended is entirely inadequate under Utah conditions, and that only with a sufficient degree of isolation are the roguing and selection methods effective. In connection with this investigation spindle tuber was found generally distributed in the State.

Some attention was paid to diseases of canning crops, particularly peas and tomatoes. With peas four fungi were found responsible for the root rot, but *Aphanomyces* sp. was the most important one. The black leaf of the pea has been found generally distributed in North Cache and Morgan Counties, and studies on the life history of the causal organism, methods of dissemination, relation of the parasite to climate, and control measures are being carried on. With tomato diseases particular attention was paid to the Fusarium wilt, which is said to be rapidly becoming a limiting factor in tomato production in the State. Tests of varieties resistant to disease were carried on, and the variety Norton was found to exhibit a high degree of earliness. It is believed that this variety could be substituted for the ones commonly grown in Utah for canning purposes. The nature, cause, and means of control of western yellow blight, and also of mosaic, are being investigated.

As a result of a plant disease survey the author reports the occurrence of Cytospora of poplars, dry rot or Phoma rot of sugar beets, chlorosis of various perennial plants, and a number of diseases of the raspberry and strawberry which are said to be peculiar to the intermountain region. The occurrence of the nematode and crown wart of alfalfa is reported for the first time, and crown wart is said to be rather generally distributed in certain alfalfa-growing districts of the State.

Dry rot, seedling sickness, and late blight or Phoma rot of sugar beets are under investigation. The Phoma rot or late blight has been found to be closely correlated with drought occurring late in June and July.

Plant parasitic diseases in the Valley of Bareges [trans. title], J. DUFRENOY (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 371-375).—Within the very limited area here indicated a considerable number of disease fungi were noted, the generic coefficient (genera÷species) being rather low, namely, 32 per cent for the whole mycological flora of the area in question.

Fungus diseases of cultivated plants in Egypt and their control [trans. title], K. SNELL (*Angew. Bot.*, 5 (1923), No. 3, pp. 121-131).—Brief accounts are given regarding disease incidence and control measures in case of cotton, clover, wheat, and miscellaneous plants of lesser importance economically.

Congress of Plant Pathology, Strassburg, 1923 (*Congrès de Pathologie Végétale, Strasbourg, 1923*. [Paris]: *Min. Hyg., Assist. [etc.]*, 1923, pp. 74).—In addition to addresses in recognition of the work of Pasteur and various general topics by H. d'Andlau, P. A. Dangeard, C. L. Shear, J. Magrou, and P. Vuillemin, the following contributions on plant pathology were presented:

A Review of Studies at the Botanical Institute at Bern on the Biology of Parasitic Fungi, by E. Fischer; The Central Bureau of Fungus Cultures at Baarn, Netherlands, and An Account of Cultures Made by the Bureau, both by Bolle; Action at a Distance by Phytopathogenic Fungi, by C. Picado; The Formation of Chlamydospores in Oak Oidium, by L. Petri; Overwintering Among the Erysiphaceae, by E. Foex; Diseases and Animal Parasites of Chrysanthemum Cuttings, by J. Chiffot; a communication on grape downy mildew (*Plasmopara viticola*) and its control, by J. Capus; The Modification of Leaf-Surface Conditions by Copper Sprays, by M. Gard; The Comparative Anticryptogamic Values of Copper as Compared with Those of Lime Sulfur Sprays, by C. Chabrolin; The Value of Copper Salts in Viticulture, by P. Gervais; Esca, by P. Marsais, dealing with a grapevine rapid wilt (known in the Peloponnesus under the name ischa, following which the author proposes the name esca); and Agricultural Intelligence and Phytopathology, by J. Chaptal.

A new chapter in plant pathology, linking that science with animal pathology [trans. title], [H.] QUANJER (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 1, pp. 22-40).—The author claims that phytopathology may contribute in a certain measure to medical and veterinary science.

Notes on the biology of rusts and smuts [trans. title], L. BLARINGHEM (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 172-182).—The present report deals with phases and facts generally analogous to those previously set forth (*E. S. R.*, 33, p. 145), the main present subject being variability in mallow rust (*Puccinia malvacearum*) on green and on variegated plants of *Lavatera arborea*.

The toxicity of copper [trans. title], C. CHABROLIN (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 132-137).—Discussion is given regarding the propositions recently upheld by the Villedieus regarding the alleged nontoxicity, as employed, of copper to pathogenic fungi.

A miniature copper carbonate duster, A. H. HOFFMAN (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 8, pp. 482, 483, fig. 1).—For the purpose of applying effectively copper-carbonate dust to seed in experimental parcels without danger to health, a revolving box mixer is made by furnishing two diagonally opposite corners with wire nails as journals, one of these being bent to form a crank to turn the box so as to mix thoroughly the dust with the seed.

Color indicators for blight disinfectants, H. A. CARDINELL (*Science*, 60 (1924), No. 1559, p. 455).—In order to secure a better covering of exposed tissues after cutting out blighted areas, the author recommends the addition of fuchsin red to the Reimer-Day mercury and glycerin solution. This adds a pronounced color to the solution and permits the operator to detect any small untreated surface and to tell at a glance whether all the cut tissues in the tree have been treated. Field observations have not indicated any diminution in the effectiveness of the material, and the treatment, because of the greater thoroughness, is more effective.

A mycorrhizal fungus in the roots of legumes and some other plants, F. R. JONES (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 9, pp. 459-470, pls. 2, figs. 3).—The author reports having found during a study of the fungus parasites of the roots of peas and other legumes that the roots of nearly all the common leguminous crops are extensively invaded by a characteristic fungus which has previously been known in a considerable number of plants as a mycorrhizal fungus. This is said to be so abundant that it is considered unlikely that many plants, such as alfalfa, clover, peas, etc., ever reach maturity without their roots being more or less invaded. The fungus is found only in the

primary cortex, and it exists as a coarse, nonseptate mycelium, and though it passes through the outer cells when entering the root, it is chiefly intercellular in the deeper parts, advancing in long strands toward the growing end. New roots of perennial plants, such as clover and alfalfa, contain but little of the fungus, but by midsummer the rootlets become invaded almost to their tips. In a single plat experiment clover, alfalfa, and sweet peas were found to grow more vigorously in soil in which the fungus had been killed by formaldehyde, but it is not considered certain that the absence of this parasite is the only factor which was responsible for the benefit. In addition to a large number of leguminous plants the fungus has been found in the roots of plants representing a number of other families.

A cereal collar disease [trans. title], [E.] MIÈGE (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 1, pp. 53, 54).—At Mazagran, in 1921, the author for the first time observed a cereal stem base break affecting about 10 per cent of the plants, the same trouble causing, in 1922, serious injury at points named. From the brief studies effected to date of this account, it does not appear to be a case of foot or stalk disease usually ascribed to an *Ophiobolus* or to a *Leptosphaeria*, neither of these fungi being present.

Observations on *Sclerotium oryzae* in Cochín China [trans. title], F. VINCENS (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 112-131, figs. 7).—One of the more common of the parasites of rice in Cochín China is *S. oryzae*, observed by the author as causing injury there as early as 1919. A study is outlined of this organism and its relationships. An account is given in this connection, with descriptions, of *Beauveria oryzae* n. sp. forms α and β , of *Acremonium fuliginosum* n. sp., and of *Fusarium oryzae* α and β .

***Fusarium* attack on wheat** [trans. title], L. DOYER (*Angew. Bot.*, 5 (1923), No. 3, pp. 160-164).—Facts and comments offered herein refer primarily and largely to matter contained in statements by Atanasoff, some of which have been noted (*E. S. R.*, 44, p. 243).

Smut control test, A. F. BRACKEN (*Utah Sta. Bul.* 192 (1925), p. 23).—A comparative test of the efficiency of formalin, copper sulfate, and copper carbonate dusting treatment in smut control of wheat is said to show that copper carbonate prevented smut, and, in addition, it increased the yield over the two wet treatments.

***Alternaria* leafspot and brownrot of cauliflower**, J. L. WEIMER (*Jour. Agr. Research* [U. S.], 29 (1924), No. 9, pp. 421-441, pls. 4, figs. 3).—The results are given of a study of a leaf spot of cauliflower caused by *A. brassicae*. In addition to attacking the leaves the fungus causes a brown rot of the curd of cauliflower. The cultural relations of the organism were determined, and suggestions are made for the control of the disease. In the case of cauliflower heads it is suggested that field infection should be prevented by thorough spraying with Bordeaux mixture 4-4-50, and in shipment to keep the temperature as low as possible, 7° C. (44.6° F.) or lower.

The control of damping off of cotton seedlings by the use of Uspulun, H. R. ROSEN (*Science*, 60 (1924), No. 1556, p. 384).—In an attempt to protect cotton seedlings from damping-off in some cotton breeding work the author watered several rows with a solution of Uspulun as recommended, about a gallon of the solution being applied to each square foot of soil. No further damping-off occurred in the treated rows, though untreated ones were badly infected. A microscopic examination of diseased plants is said to have shown that most, if not all, of the damping-off was due to *Rhizoctonia*.

Three new diseases of the hop, E. S. SALMON and H. WORMALD (*Jour. Min. Agr.* [Gt. Brit.], 30 (1923) No. 5, pp. 430-435, pls. 2; abs. in *Jour. Inst. Brewing*,

29 (1923), No. 9, pp. 783, 784).—In this article three fungus diseases of the hop, new to Great Britain, are described. The first, downy mildew (*Pseudoperonospora humuli*), is an introduction from Japan or from America. The second, leaf spot, causes a spotting of the hop leaf, but so far as observed no serious injury. The fungus indicted is called *Cercospora* n. sp. The third, for which the name hop drop has been proposed, is associated with the presence of a minute fungus (*Macrosporium* sp.) which attacks the stalk of the cone, eating it through and causing it to fall to the ground. These are discussed as to history.

Potato diseases, G. R. HILL (*Utah Sta. Bul.* 192 (1925), pp. 34, 35).—A brief report is given of physiological studies conducted to determine whether seed potatoes produced at high elevations in the State were better than those grown in the larger, warmer valleys. The results of five years' work are said to indicate that in general normal plants showing no indication of disease differ in their behavior when grown at the different elevations, but the controlling factors varied so widely that the results were not the same for each year.

Potato leaf roll [Loire] [trans. title], C. PERRET (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 884-889, figs. 3).—Experimental infection at the Merle Experiment Station during 1921 and 1922 proved successful regarding the transmissibility of potato leaf roll. Plans for amelioration of conditions in regions showing leaf roll are based upon selection, and such plans are outlined as applicable to fields, regions, and stations.

The Rhizoctonia disease of the potato, B. F. DANA (*Washington Col. Sta. Pop. Bul.* 131 (1925), pp. 5-30, figs. 6).—A popular account is given of the Rhizoctonia disease of potatoes, together with the results of experiments for its control by the treating of the seed tubers. The author recommends the selection of tubers visibly free from the parasite and their treatment by dipping them in water and keeping them moist from 12 to 24 hours, after which they are treated with a solution of corrosive sublimate 4 oz. to 30 gal. of water for 1.5 hours. When treating large lots of seed the author recommends for each 4 bu. of seed treated the addition of 0.5 oz. of corrosive sublimate after each lot is removed. Hot solutions of formaldehyde or corrosive sublimate are said to be more rapid in their action and to permit of greatly shortened time of treatment.

Pear leaf blister (*Taphrina bullata*, Tul.), H. R. BRITON-JONES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, pp. 89, 90, fig. 1).—This infrequent disease, which is described, was common on different pear varieties during the summer of 1923. It may, it is thought, be controlled by spraying with summer strength lime sulfur (treatment for scab, employing 1 gal. of the concentrated solution to 29 gal. of water). Differences in severity with different varieties are indicated.

The purple leaf blotch of strawberry, H. R. BRITON-JONES (*Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, p. 88).—Strawberry purple leaf blotch has been found to be due to attack by an aphid (*Myzus fragariella*), the crinkled surface and split edges being due to the growth of the unpunctured areas. Spraying does not readily reach the aphids within the close folds of very young leaves.

Red plant in strawberries and its correlation with "cauliflower disease," E. BALLARD and G. S. PEREN (*Jour. Pomol. and Hort. Sci.*, 3 (1923), No. 3, pp. 142-147, pls. 5; also in *Univ. Bristol, Agr. and Hort. Research Sta. Ann. Rpt.*, 1923, pp. 83-87, pls. 4).—Recognized by growers for a number of years, strawberry red plant became, in 1922 and later, more familiar and

enormously extended as regards area, seriously threatening the industry in certain districts. The symptoms are detailed, as are also those of the cauliflower (nematode) disease (*Aphelenchus fragariae*). The correlation studies show a constant overlapping of the symptoms of these troubles, and a consideration of all the factors leads to the conclusion that the two conditions are two aspects of one and the same disease. Apparently, the disease may pass from the parent plant along the stolon to the young plant. Much work of a comparative nature remains to be done. None of the 50 strains yet examined have displayed complete immunity.

Grape mildew control [in France] [trans. title], A. CADORET (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 869-872).—The author is convinced, as the result of early and more recent investigation, that north of a line running from Bordeaux to Briançon (about 45° N. latitude) copper sulfate sprays which are sufficient in dry years may be wholly ineffective in years of high precipitation. In 1910, 1915, 1916, and 1920, 12 sprayings in each year were not entirely protective. In such years only the blue vines (visibly covered with copper sulfate and lime) are able to resist fungus attack.

Plans regarding treatment are outlined for this region, also for the more southern parts of France, as well as for Algeria and Tunis.

Geranium stemrot caused by *Pythium complexens* n. sp., H. BRAUN (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 8, pp. 399-419, pls. 5, figs. 3).—The author reports the isolation from blackened geranium stems in 1919 of *P. debaryanum* and three other fungi belonging to the same genus. The present paper gives an account of one of these isolations, which differed very markedly in morphological and cultural characters from *P. debaryanum*. The disease consists of a progressive basal blackening accompanied by pectinization and soft rot of pith and cortex. Infection stops at a sharp line of demarcation from 20 to 40 mm. from the base within from six to eight days after inoculation. Stoppage of the infection is said to be due to a host resistance reaction manifested by the formation of a cork cambium completely across and within the stem. This reaction is considered specific for this particular host and organism, and was not found in the case of three other species of *Pythium*, nor in the case of cuttings of other species. A technical description of the organism is given. The significance of the *Pythium* type of sporangial germination is discussed.

Schizophyllum commune on Japanese chestnut [trans. title], BIERSE (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 151-153).—An importation of Japanese chestnut was placed under conditions favoring fungus development, and soon after showed the presence of *S. commune*. This fungus can evidently be transported for long distances in a viable condition, and it is recalled that Futterill has previously (*E. S. R.*, 48, p. 247) confirmed its capability as a dangerous parasite.

Armillaria (Armillariella) mellea and walnut rot [trans. title], GARD (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 1, pp. 55-62, pls. 4).—The honey fungus (*Armillaria mellea*) rot has been studied locally in black walnut (*Juglans nigra*), and it is stated that the injury ceases its advance on proper application to the infected area of iron sulfate, potassium permanganate, or formol. The tree does not die in such cases unless the fungus has encircled the crown or has involved all of the roots.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Spread of the European starling in North America, M. T. COOKE (*U. S. Dept. Agr., Dept. Circ.* 336 (1925), pp. 8, fig. 1).—This is an account of the

introduction and spread of the European starling in this country. Since its introduction at New York City in 1890, which led to its permanent establishment, the starling had spread until on December 15, 1924, its range extended from central Maine to central Ohio and Michigan and from southern Canada to Georgia and Florida, throughout much of which territory, however, it is still of only local occurrence. In the region contiguous to New York City it has become one of the most abundant birds. Thus far it has not been found to be as seriously destructive to crops in the United States as it is reported to be in some parts of the Old World.

Report of the department of biology for the year ending June 30, 1923, T. C. NELSON (*New Jersey Stat. Rpt. 1923, pp. 195-209, pl. 1, figs. 2*).—This report deals with studies of the oyster and of marine borers. Marked fluctuations were found to occur in the H-ion concentration of the water of shallow estuaries tributary to Barnegat Bay, fluctuations as great as pH 0.52 being observed between dawn and later in the day.

The first phase of the investigation of the food of the oyster was completed, a final summary by G. W. Martin being presented. The actual attachment of oyster larvae was observed and is here described for the first time. They were found to describe circular movements before coming finally to rest. The larva holds on with the foot, while attachment is effected through the pouring out of cementing fluid from the byssus gland in the base of the foot, distribution of the fluid being aided by the extended border of the mantle. Important practical bearings of the observation are discussed.

The larvae of marine borers were found to congregate about the bases of piling, thus substantiating the laboratory findings of C. H. Harrington that shipworm larvae are attracted by wood extracts. Examination of piling drawn from the bridge at Barnegat Pier showed a high degree of protection afforded by good creosoting, untreated piling having been practically destroyed through the activities of *Bankia* and *Teredo*.

Personality of insects, R. DIXON and B. EDDY (*New York: Charles W. Clark Co., 1924, pp. [12]+XI+247, pls. 33*).—This is a popular account of insect bionomics.

Report of the department of entomology [of the New Jersey Stations], T. J. HEADLEE ET AL. (*New Jersey Stat. Rpt. 1923, pp. 37-42, 265-337, pls. 3, figs. 4*).—The investigation of Milltown ball clay No. 9 was continued (E. S. R., 51, p. 658) with a view to determining how its preventive action against insect infestation of beans takes place. A careful observation of its action upon bean weevil larvae has shown that they are unable to grapple the bean surface because of the slipping of fine particles of dust which the claws and frequently the anal sucker seize upon. It is concluded that the efficiency of dusts as agents in preventing the infestation of the bean seed by bean larvae is correlated with the size of the particles composing them and the ease with which one particle moves upon another.

The codling moth investigations were continued at Glassboro. As relates to the value of the three usual sprays, the experience of two years seems to indicate: "(1) That when fighting very heavy and intensive infestations of codling moth it is essential that the coating of fruit and foliage be maintained during the periods when the larvae of the first brood and the larvae of the second brood are hatching and trying to enter the apples, (2) that this coating can be maintained almost or quite without accessory spraying if an adequate spreader and sticker is incorporated into the spraying mixture, and (3) that the cost of this operation is sufficiently small to justify its employment where codling moth infestation conditions demand drastic measures."

The details of work on types of materials and methods of application, conducted in four orchards with codling moth and curculio, and in two with aphids, are presented in tabular form. A discussion of the New Jersey dry mix, a detailed account of which, by Farley, has been given in Bulletin 379 (E. S. R., 49, p. 349), follows. It is pointed out that the combination of elemental sulfur, hydrated lime, and powdered lead arsenate apparently gives a very satisfactory control of both the disease and insects attacking the peach. Tests of dusts composed of these three materials indicate that, while dust materials can be applied to apple without serious burning, the control of apple insects, such as codling moth and curculio, was only about half as good as that obtained by water-suspended materials, due to the failure of the dusts to stick to the fruit and foliage. The observations indicate that there is little danger of burning with the combination of elemental sulfur, hydrated lime, and powdered lead arsenate applied as a water suspension, and that the activity of the arsenate of lead is in no way interfered with. The author is firmly convinced that film coatings are necessary for the control of codling moth when it is very abundant, although spot coatings are reasonably adequate when it is comparatively scarce.

In discussing the relation of time of application to seasonal development of the apple tree, it is pointed out that the application of spray No. 1 depends entirely upon the development of the apple tree and is not affected by the development of the codling moth, because the lead arsenate which is in the calices of the young apples is inclosed by the closing of the calyx and seems to remain in position throughout the time that the codling moth larvae of both broods are trying to enter the fruit. The time of application of spray No. 2 is determined by the gathering of 100 specimens of uninjured codling moth larvae early in the spring and observing when moths have emerged from 50 per cent of the living pupae, at which time the maximum emergence of moths has taken place and spraying should be commenced. The time of application of spray No. 3, which also depends upon the development of the moth itself, is determined by the collection of 100 healthy larvae from bands placed on from 5 to 10 trees distributed throughout the orchard and observing when about 30 per cent of the living pupae have given up moths, at which time spraying for the second brood should be begun.

A continuation of work with the pear psylla indicates that the dormant treatment has a long-continued influence on the abundance of the psylla, reducing the overwintering brood to such an extent that it lays only one-third as many eggs as would otherwise have been the case. The effect of the preblossom treatment is also marked. No conclusions could be drawn from psylla treatments made after the preblossom treatment because they were not correct as to time.

In a search for a sticker for lead hydrogen arsenate, a laboratory study of the sticking power of casein (Kayso form), high gluten wheat flour, and powdered sweet skim milk led to the conclusion that the optimum amount of gluten was not far from 3 per cent. The results indicate distinctly that with Kayso, flour, or milk more than twice as much of the lead is retained on the foliage as that when they are absent from the mixture. Of the three, it seemed that the flour was slightly the best. The addition of Kayso and powdered skim milk to the lead arsenate tends to reduce the water-soluble arsenic, and the addition of flour does not increase it.

A report of the Cranberry Substation is presented by C. S. Beckwith (pp. 299-307), part of which is noted on page 740. In continuing the work with the cranberry girdler, a plat 20 ft. square was flooded, resulting in 53 girdlers floating during the first 12 hours and none during the second 12 hours, at the

end of which time 60 per cent of those floating were dead. Girdlers which were submerged in a cheesecloth bag for 24 hours were all dead at the end of that time. The 24-hour reflow in August reduced the cranberry girdler infestation from 95 to 100 per cent on each of five bogs under observation, being 99 per cent or better on four of them.

In control work with wireworms it was found that the only corn seeds not eaten were those treated with corrosive sublimate or carbolic acid. The worms were not injured when treated with corrosive sublimate, but apparently they were killed by the gases given off by the carbolic acid. Bee investigations, including the relation of honeybees to fruit growing, the causes of certain bee diseases of obscure etiology, and the breeding of bees resistant to foulbrood and of high producing strains are reported upon by R. Hutson (pp. 313-323).

The mosquito campaign, conducted in continuation of that of previous years and reported upon at some length, includes discussions of the drainage of the salt marshes, the prevalence of mosquitoes on the wing, correlation of mosquito commission work, and of educational and administrative work, by W. M. Walden. A report upon the relation between atmospheric conditions and the behavior of mosquitoes, by Rudolfs (E. S. R., 50, p. 757), has been noted.

Work with the peach borer (E. S. R., 51, p. 457), blackberry psyllid (E. S. R., 49, p. 353), and pepper maggot (E. S. R., 49, p. 356), and with nicotine dust (E. S. R., 50, p. 254) is briefly summarized.

Entomology [studies at the Utah Station], I. M. HAWLEY (*Utah Sta. Bul.* 192 (1925), pp. 42-44).—In control work with the fruit-tree leaf-roller 44 different dormant oil spray treatments were applied to prevent hatching of the eggs. There was apparently a wide variation in effectiveness, although in some cases 96 per cent control was obtained. Two applications were made, one before the buds burst, the other when the first leaves were out. In 1924 the early spray gave the better control, whereas in 1923 the later spray gave the better results. This is explained by a difference in the season, the eggs hatching much earlier in 1924. Arsenate of lead was used with poor success against the caterpillars.

In control work with the blister mite 25 fall and spring applications of commercial oil and sulfur compounds were used against the overwintering mites. Some sulfur compounds, such as lime sulfur, dry lime sulfur, and soluble sulfur, applied either in the fall or spring, gave a control running in some cases as high as 99 per cent. Some oils gave fair control, but with others there were as many scars on the leaves as in the checks.

The life history of the sugar-beet root-maggot has been worked out. It passes the winter as a larva in beet fields, the fly appearing in the spring about thinning time and depositing its eggs in the ground near the young beets. The larvae upon hatching out feed on the roots of the beets and often cut off the tip, in which case the beet dies. Early irrigation of the beets is thought to keep the maggots feeding above the tip, thus preventing its being cut off.

Four separate treatments of paradichlorobenzene were applied for the peach borer, three in the fall at intervals of two weeks and one the following April. Control was nearly 100 per cent effective in all cases, the spring and fall applications being equally so. Thirty-six combinations of insecticides were used against four species of ants that are common in peach orchards and gardens as well as in grain fields. Calcium cyanide was most effective when driven into the nests with a dusting machine. Carbon disulfide gave good control in some cases, and a bait of sodium fluoride, sugar, and cornstarch was effective against some species. Nicodust used against the pea aphid on sweet peas and the currant and cabbage aphids gave good control.

An annotated list of the species of injurious insects and their parasites recorded from Italy up to the close of 1911, I, II [trans. title], G. LEONARDI (*Ann. R. Scuola Super. Agr. Portici*, 2. ser., 17 (1922), [Art. 4], pp. 147; 18 (1923), [Art. 5], pp. 80).—The first part of this work consists of a bibliography; the second part lists the Collembola, Orthoptera, Isoptera, Dermaptera, Corrodentia, Thysanoptera, and Hemiptera.

The control of truck crop pests by dusting, E. N. CORY (*Md. Agr. Soc., Farm Bur. Fed., Rpt.*, 8 (1923), pp. 378-381).—The author points out that tests at the Maryland Experiment Station have shown nicotine dusts to be effective against the garden fleahopper, the bean aphid, and, with certain limitations, against the asparagus beetle.

On the succession of insects living in the bark and wood of dying, dead, and decaying hickory, M. W. BLACKMAN and H. H. STAGE (*N. Y. State Col. Forestry, Syracuse Univ., Tech. Pub.* 17 (1924), pp. 3-269, figs. 53).—This is a contribution from the department of forest entomology of Syracuse University. A bibliography of 22 pages is included.

Problems and methods in forest entomology, I. TRAGARDH (*Jour. Forestry*, 22 (1924), No. 6, pp. 64-78).—This is an address given at Stockholm in June, 1923, in which the problems met with and some of the methods employed are considered. A discussion of the paper by F. C. Craighead follows (pp. 79-81).

The termites, E. HEGH (*Les Termites. Brussels: Industrielle & Financière*, 1922, pp. 756, pl. 1, figs. 460).—This account of the termites deals with their geographical distribution, classification, biology, economic importance, etc. A bibliography of 33 pages is appended.

The grape leafhoppers of bluegrass Kentucky, H. H. JEWETT (*Kentucky Sta. Bul.* 254 (1924), pp. 87-130).—This is a report of biological studies of leafhoppers found infesting the grape at the station from 1920 to 1922, including *Erythroneura comes vitis*, *E. comes comes*, *E. comes octonotata*, and *E. vulnerata*. *E. tricolorata* was observed only occasionally. Observations of the sycamore leafhopper *Erythroneura* sp., which is closely related to the grape-infesting leafhoppers, are included. Much of the data is presented in tabular form. No reference is made to the literature, but a partial bibliography, consisting of 54 titles, is appended. A key to the Nearctic forms of *Erythroneura*, by McAtee, has been noted (*E. S. R.*, 44, p. 352.)

Sprays to be effective must be applied when the insect is in the nymphal stage and when the nymphs become numerous on the vines, from the middle of July to the first of August. The nymphs are sensitive to nicotine sprays and may be killed by a solution of nicotine sulfate at a dilution of 1 part to 1,400 parts of water. A dilution of 1 pint of nicotine sulfate to 200 gal. of water is nearly as effective as the stronger solution and may be applied with good results when the nymphs are not too far developed. The 1 to 1,400 solution killed from 97 to 100 per cent and the 1 to 1,600 solution 96.5 to 100 per cent of the nymphs of various sizes.

The citrus aphid, *Aphis spiraeicola* Patch, W. W. YOTHERS and F. R. COLE (*Citrus Indus.*, 5 (1924), No. 10, pp. 6-8, 18, 19, fig. 1).—In the introduction to this account, it is pointed out that experiments by A. C. Baker and the authors have shown that the aphid on *Spiraea* (*A. spiraeicola*) reproduces abundantly on citrus trees and also that the citrus aphid reproduces normally on *Spiraea*, several transfer tests having been made with identically the same results. *A. spiraeicola* has been reported from some 12 States extending from Maine, Virginia, and Alabama to Colorado and California. Its primary food plants appear to be *Spiraea cantoniensis* and *S. vanhouttei*, and in the northern

regions it is upon these plants that the eggs are deposited in the fall. In Florida the aphid has been found most abundant on the King, Temple, Satsuma, and Tangerine oranges, the sweet orange being next in preference, while grapefruit is not very severely injured. It is also found on loquats, sand pears growing near citrus trees, and on wild plum. In the laboratory it bred successfully on nightshade, Jerusalem oak, milkweed, dogfennel, cudweed, lettuce, and peppers. The total number of living young produced by the average female varies from 8 to 61. There are five stages from birth to maturity.

No less than eight species of predacious enemies have been observed to feed upon the aphid, but they were not very effective in holding it in control during the year. A fungus disease is said to have been an important factor in the reduction of numbers of aphids on citrus trees in the infested area during the summer. A spray of nicotine sulfate 1-800 with soap at the rate of 2 lbs. to 50 gal. of water is said to kill all the aphids hit. Oil emulsions, which cost much less than the nicotine sulfate spray, were found to be equally effective. Dust composed of 3 per cent nicotine or 7.5 lbs. of nicotine sulfate to 92.5 lbs. of hydrated lime is perhaps the most effective remedy for control of the pest, but is extremely expensive. Dusts consisting of 2 per cent nicotine, 40 per cent sulfur, and 58 per cent inert ingredients, also gave good results. It is pointed out, however, that practically all the spraying and dusting of the pest has been of little or no value in reducing its numbers, due to its rapid increase. In the control of this pest it is of primary importance that the control measure be applied before the infestation becomes general.

A note on the influence of climate on this pest, by Baker, accompanied by climatographs, is included.

Some field observations on the new aphid, K. E. BRADON (*Citrus Indus.*, 5 (1924), No. 9, pp. 9, 24).—The author reports that damage to many citrus trees, particularly trees 10 years old or younger, has been such that no growth could form during the spring. Practically all the fruit dropped, and the little that remained was warty and deformed. Older trees as a rule did not suffer so greatly, but many lost considerable fruit and growth, and the fruit was at first very rough and unsightly in appearance. Later in the season the fruit was growing out of this condition and promised to be normal when mature. It is pointed out that grapefruit trees appear to have been nearly immune from attack, although isolated cases of infestation were observed. While the orange trees that were severely injured in the spring as a rule made good recovery during the summer, the recovery was not complete and the great loss of early fruit was not made up by a June bloom. In sections of the State visited by the author there was little or no late bloom, and many and various attempts to force a late bloom by applications of nitrate of soda, heavy amounts of regular fertilizer mixtures, extra cultivation, etc., were made with practically no success. The author concludes that the sprays and dusts that were applied did not pay in actual results for the material and labor involved. It is also pointed out that the aphids will live only on very tender growth, and that long before it has reached its full development they will leave in search of younger growth or perish for lack of food.

The new citrus aphid, J. R. WATSON and A. H. BEYER (*Citrus Indus.*, 5 (1924), No. 11, pp. 30, 31, fig. 1).—This is an abstract of discussions of the new citrus aphid, including work previously noted (E. S. R., 51, p. 660).

Life history of the new citrus Aphid, A. H. BEYER (*Fla. Ent.*, 8 (1924), No. 1, pp. 8-13).—The author first reports upon generation studies, carried on in the field at Lakeland, Fla., from May 2 to June 20, of the citrus aphid since identified by Baker as *A. spiraeicola* Patch as noted below. The longevity of

the females ranged from 3 to 21 days. The reproduction period varied, during the time of the studies, from 2 to 11 days, with an average of 5 young per day. The total number of young produced varied from 8 to 61. Control measures are also considered.

Controlling the citrus aphid (*Aphis spiraeicola* Patch), J. R. WATSON and A. H. BEYER (*Florida Sta. Bul.* 174 (1925), pp. 79-96, figs. 9).—This is a practical summary of information on the citrus aphid, which has risen to a place of great economic importance in Florida. Earlier accounts of this aphid, which first appeared and caused serious injury in the southwestern part of the citrus belt in the spring of 1924, are noted above.

It is pointed out that this aphid, the native host of which appears to be members of the genus *Spiraea*, was described by Patch as *A. spiraeicola*, and is closely related to *A. pomi*. It can not live on mature citrus foliage or twigs, and many aphids born on the hardening foliage develop wings and fly away. On *spiraea* its behavior is quite different, since it can feed on the mature leaves and does not require new growth. In addition to feeding on *spiraea* through the winter, when there is no new growth on the citrus, it has been observed to oviposit thereon. In Florida it has also been observed to oviposit on *Pyrus delutaefolia* and the Japanese flowering quince, both of which are rare in the State. It is concluded that in many sections, particularly in the northern part of the citrus belt, it is *spiraea* that enables the aphid to live over the winter, when there is no new growth on the citrus trees. The danger to citrus communities from this source leads the author to recommend strongly the destruction of *spiraea* throughout the citrus belt. While it has been observed on a number of other host plants, these appear to be of a secondary nature and probably of minor importance.

The spread of this aphid in Florida is said to take place almost entirely by means of flight. The average length of the five stages varies from 20 to 64 hours. The first three nymphal stages are approximately of equal length, but the fourth stage is longer. During the late spring and summer the total average length of the nymphal life, from birth to maturity, was 4 days, and in December 6.5 days. The life of the females was found to range from 3 to 47 days, the reproductive period varying from 2 to 24 days. The maximum number of young produced by a single female is 64 and the minimum 8. The percentage of winged individuals produced during the experiments conducted ranged from 45 to 69. Until late in the fall no males were observed, the females reproducing parthenogenetically and bringing forth living young. This type of reproduction also continued all winter, but as cold weather came on, about December 1, some males were produced and eggs laid on some plants, but not on citrus.

Mention is made of a number of predacious insect enemies, an egg parasite, and at least one fungus parasite (*Entomophthora* sp.). It is pointed out that in control work it is important to delay the general infestation of a grove as long as possible, and for this purpose spot dusting is recommended. This consists in the inspection of the grove once or twice a week for any infested trees or parts of trees and the application, when an infestation appears, of a 3 per cent nicotine sulfate lime dust. Calcium cyanide has also been used extensively in the State for spot dusting with apparently good results. On very young trees infested twigs may be dipped in a contact insecticide. Where a heavy infestation of purple scale develops in the curled leaves, pruning is the most satisfactory method of dealing with it.

When infestation becomes quite general, the application of a 3 per cent nicotine sulfate lime dust, or a spray, which is more economical, should be made.

The early application of oil emulsion may be advisable. It is pointed out that in many cases it is possible to combine the control of the citrus aphid with that of other pests and greatly reduce the cost of control measures. In the case of oranges of the mandarin type the addition of 1 part nicotine sulfate to 800 parts of Bordeaux will render the solution very effective against the aphids and not lessen its fungicidal action. For the control of rust mites and red spiders an application of 1 pint of nicotine sulfate to each 100 gal. of lime-sulfur solution is recommended. If it is desired to control rust mites as well as aphids, a combination dust can be secured by adding from 10 to 15 per cent of sulfur in the nicotine sulfate lime dust.

The importance of keeping the grove dormant during the fall by cultivating as little as possible after the rainy season is pointed out. Such groves were exceptionally free from aphids by the first of February, and the infestation developed slowly during the succeeding weeks. The growing of truck crops near the citrus trees during the winter was observed to be of value through furnishing parasites and predators to attack the citrus aphid.

Mention is made of three species of ants associated with the aphid, the most abundant of which is a species of *Campanotus*.

The grape phylloxera and viticulture [trans. title], O. SCHNEIDER-ORELLI (*Neujahrsbl. Naturf. Gesell. Zürich*, No. 125 (1923), pp. 15, pls. 4, figs. 4).—This is a discussion of the subject as applied to European conditions.

The European corn borer, L. L. HUBER and C. R. NEISWANDER (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 11-12, pp. 192-197, figs. 3).—This is a progress report on the European corn borer (*E. S. R.*, 51. p. 255), which appeared in Ohio in 1921 and has spread rapidly in the State, its spread in 1924 having been more extensive than the total spread during the three preceding years. The average infestation in 1923 rose to between 1 and 2 per cent, with a maximum of 17 per cent. It increased in 1924 to an average infestation of 15 per cent and a maximum of 46 per cent. In a large field of dent corn which had an infestation of about 43 per cent, several hundred ears taken from infested stalks when compared with an equal number of ears from uninfested stalks showed a difference in weight of about 2 per cent. In 1923 the infested stalks showed an average of slightly more than one borer to the stalk, while in 1924 there was an average of two borers each.

Report of progress of the orange Tortrix investigation, A. J. BASINGER (*Citrus Leaves*, 1924, No. 9, pp. 1-3, figs. 6).—This is a report of studies, conducted in 1923, of the life history of *T. citrana* Fern., known as a pest of oranges in California for nearly 40 years.

The eggs are deposited in flat patches, the egg mass varying from a few to several hundred, with an average of about 30, being placed on either the upper or lower surface of the leaves. They hatch in from 8 to 10 days during the spring and summer, and the young larvae seek the tender growth at the tips of twigs, where they web together two or three of the leaves, or make a nest in a curled leaf, feeding on the tender leaves or fruit hanging near by. From 40 to 50 days, or longer if there be a scarcity of food or cold weather, is required for completion of the larval period. Pupation takes place within the nest occupied by the larvae, 10 to 14 days being passed in this stage. While the number of generations each year has not been definitely determined, at least four are indicated.

The species is known to occur in southern California from San Diego to San Louis Obispo Counties, but most commonly in Los Angeles and Orange Counties, the section from Pasadena to Pomona being the center of greatest infestation in Los Angeles County and from Fullerton to Tustin in Orange County. The im-

portance of this pest consists largely in the damage caused by the larvae to oranges while the fruit is still on the tree, but occasionally a larva accidentally gets into a packed box of fruit and continues to feed and grow there, and is responsible for some damaged fruit. In feeding on an orange the larva eats into the skin, often boring a hole through it and a short distance into the flesh. If a Tortrix-injured orange gets by the sorting table it may decay and cause an appreciable amount of loss in that way. Some fruits are also destroyed at blossoming time by the larvae nibbling at the ovaries in the blossoms. Periodic outbreaks of the greatest severity are occasionally noted. The amount of fruit actually lost varies from a negligible percentage to as much as 20 or 25 per cent of the crop.

The author has reared six primary parasites from *T. citrana*, particularly *Apanteles aristotelidae* Vier., and *Hormius basalis* Prov., the former being by far the most important and responsible for 75 per cent of the total parasitism. The natural control has risen gradually from about 10 per cent during the winter to from 75 to 90 per cent in the various districts at the present time.

Platynota tinctana Wlk., another orange worm of less importance, is also under observation.

Australian fruit crop endangered by fruit fly, M. BLAKE (*Calif. Citrogr.*, 10 (1924), No. 1, p. 31, fig. 1).—Attention is called to the appearance of the Mediterranean fruit-fly in the Mildura fruit-growing area, one of the most important in Australia.

Winter trapping of the fruit-fly, *Ceratitis capitata* (Weid.), L. J. NEWMAN (*Jour. Dept. Agr. West. Aust.*, 2. ser., 1 (1924), No. 2, pp. 177-181, figs. 7).—Studies of the life history of the Mediterranean fruit-fly have shown the occurrence of an active winter generation which carries the fly into the oranges and loquats, thus bridging the living connection between the autumn and early summer.

Experimental search for baits that could be used in traps at any season of the year, especially during the wet season, have been under way for several years. Kerosene, which had previously been discovered to exercise a peculiar attraction for *C. capitata* males, was the most effective of those tested, but there was a great preponderance (90-95 per cent) of males. Further investigations led to the discovery that pollard (bran) mixed with water has a most remarkable attraction for the female fruit-fly. Twelve 10-oz. lever-lid tin trays containing the bait placed in six orange trees in a suburban garden on May 8, and the bait renewed every seven days up to September 3, resulted in the capture of no less than 6,500 flies, 86 per cent being egg-laden females. The pest is said to have been practically wiped out by means of the lure, and from September 3 to the first week in January no flies were captured. In order to preserve the pollard solution from fermentation, and so becoming less attractive to the fly, powdered borax was added. The formula recommended by the author for use in traps consists of pollard 4 lbs., molasses (optional) 4 oz., arsenate of lead (optional) 5 oz., powdered borax 8 oz., and water to make 4 gal.

The Mexican bean beetle, *Epilachna corrupta* Muls., A. E. MILLER (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 11-12, pp. 197-204, figs. 3).—This is a report of studies of the Mexican bean beetle, which was first discovered in Ohio in August, 1923 (*E. S. R.*, 51, p. 256). It now occurs in all of northern Ohio with the exception of the northwestern counties, as it does in parts of Indiana, Pennsylvania, and West Virginia, and in additional areas in States already known to be infested. In southern Ohio many growers have suffered total loss of both Lima and green beans.

The last of the three generations appears to be of little importance. The beetles first appeared on June 3, the peak of emergence occurring between June

15 and 19 and of oviposition between June 18 and 22, the latter continuing for 35 days. The eggs hatch in about 7 days, the larvae pupate 18 or 19 days later, and in 7 days the adults emerge. Oviposition by the first generation begins about 10 days after emergence. Development in the second generation is in general the same as that in the first.

Several insecticides were used in control work with similar results, all having been found to burn pole Lima beans to some extent, so that care must be taken not to exceed the amounts recommended, namely, (1) calcium arsenate 1 part, dusting sulfur 1 part, and hydrated lime 4 parts, (2) Niagara Aladust 100 per cent, (3) magnesium arsenate 1 part and hydrated lime 5 parts, and (4) arsenate of lead 1 part and hydrated lime 9 parts, the first three applied at the rate of 15 lbs. and the fourth at the rate of 18 lbs. per acre.

The Cicadellidae of the vicinity of Ithaca, New York, with special reference to the structure of the gonapophyses, J. L. BUYS (*New York Cornell Sta. Mem.* 80 (1924), pp. 3-115, figs. 183).—This is a synopsis of the leafhoppers of the Ithaca region.

The mint flea-beetle, *Longitarsus menthae* new species MS, L. G. GENTNER (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 109, 110, figs. 2).—A small brownish-yellow flea-beetle appeared during the summer of 1924 and caused serious injury to mint grown in southern Michigan. The investigations which followed have shown the pest to represent a species not hitherto known.

The larvae feed on the rootlets and mine in the main roots and lower parts of the stems during June, either badly stunting the plants or killing them outright. Injured plants take on a reddish purple tinge which is quite conspicuous at times. The adult beetles, first appearing during the latter half of July, feed upon the mint leaves, badly riddling them and causing them to turn brown and later to drop off. After feeding for three or four weeks the beetles begin to oviposit near the surface of the soil, continuing to do so until they die or until severe cold weather sets in. When the mint sod is plowed under after the first freeze in the fall the eggs become covered and receive protection during the winter months.

In order to prevent migration of adult beetles into new mint, it is thought that the dusting of a strip around the edge of the field with an arsenical dust, such as calcium arsenate 1 part to 20 parts of finely powdered raw gypsum, will be effective.

The parsley weevil (*Listronotus latiusculus* Boh.), a potential pest, F. H. CHITTENDEN (*Bul. Brooklyn Ent. Soc.*, 19 (1924), No. 3, pp. 84-86, fig. 1).—This weevil is a source of injury to the carrot through its attack principally on the upper part of the head, though in small carrots the injury may extend well down to the roots. In the larger roots the larvae sometimes bore down to a depth of a full inch, occasionally toward the center, but usually around the outer surface. Practically all carrots that are attacked by this species are ruined for market. Only one larva has been observed in a single carrot, but it is considered possible that two or three might occasionally be found in case of unusual abundance of the weevil. One grower at Astoria, Long Island, reported having lost 50 per cent of his carrot crop in 1922, and the pest had reappeared in July of the following year. The presence of this pest has also been reported from Mineola, L. I., Valley Stream, Nassau Co., N. Y., Washington, D. C., and Urbana, Ill.

Possibility of the transmission of American foulbrood of bees by caterpillars of the bee moth [trans. title], F. VINCENS (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 12, pp. 574-577).—The author's observations have led him to conclude that the caterpillars of the bee moth may consume the desic-

cated cadavers of bee larvae killed by *Bacillus larvae* White without danger to themselves, that the spores of *B. larvae* are recovered in large numbers from and live in the dejecta of caterpillars that have consumed contaminated comb, and that the bee moth caterpillars migrate from one hive to another and can transport living germs of foulbrood from a hive depopulated by this disease to a healthy colony.

Treatment for red-spider, E. I. McDANIEL (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, p. 108).—The author finds that the greenhouse red spider can be successfully combated by applications on each of three days in succession of the standard strength of lemon oil. The torpid periods, first observed by Vinal (E. S. R., 39, p. 65), during which times it is highly resistant to insecticides, last for only a day.

Apple blister-mite and its control, L. CHILDS (*Oregon Sta. Circ.* 59 (1925), pp. 8, figs. 4).—*Eriophyes pyri*, officially known as the pear-leaf blister-mite, has suddenly appeared and become widespread in apple orchards of the Pacific Northwest during the past two or three years. It has become a source of serious damage to both fruit and leaves in sections of British Columbia, the Yakima and Wenatchee districts, Spokane, and eastern and southern Oregon, as well as in the Hood River Valley. It appears to be a biological variety of the pear-leaf blister-mite, with which it is morphologically identical, since the author has found pear trees in an orchard near practically defoliated apple trees to be free from attack. On the other hand, observations were made in uninfested apple orchards in 1924 where pear trees could be found rather generally attacked.

The possibility of there being a native host plant from which the mite may have spread into the apple orchards of the different sections is suggested. Rather wide observations during the summer point to the possibility that the snowberry (*Symphoricarpos racemosus*) may be the native host involved, since it harbors a very similar if not identical mite, and apple trees near infested snowberries were always found attacked.

The first infestation observed on apples occurred in 1920 in an isolated upper valley orchard in which no pear trees were present. By 1923 their damage was so great as to cause almost complete defoliation in August, the fruit being severely russeted and of little value. The mites not only attack the young developing leaves but burrow into the flowers and stems. While they do not work long upon the young apples, they do so long enough to cause much damage, the injury appearing later in the summer as a severe russet. Often the apple is misshapen, and where generally infested it cracks open. Blister-mite infested apples seldom have more than a "C grade" or "cooker" value and are often worthless.

Control work was conducted with lime sulfur and with oil at different strengths, applied at different periods of bud development, as well as with oil combined with lime sulfur and with Bordeaux mixture. The mode of killing the mites was found to be quite different with the lime sulfur and oil, killing with the lime sulfur, which does not penetrate the bud scales, being delayed, while with oil, which penetrates the bud scales, it is immediate. The author is of the opinion that sulfur fumes being thrown off, especially on sunny days, prove to be very toxic to the young mites, causing their death, or that the young mites in leaving the buds come in contact with small particles of spray material scattered about on the unfolding bud.

In the spring of 1924, with the buds just beginning to swell, lime sulfur used at the rate of 1 to 25 permitted 7.77 per cent damage to the fruit, at 1 to 15 3.19 per cent, and at 1 to 10 1.69 per cent. In the two tests last mentioned the

injuries were merely a trace, but unsprayed trees developed 51 per cent injury. Where oil is used for the blister mite, spraying should be delayed until the buds begin to crack a little, observations indicating that a good miscible oil spray of not less than 5 per cent strength should be used.

"The results in the year's work are outstanding in favor of lime sulfur, due to the fact that the spray can be put on effectively over such a long period of time during the spring. In all orchards where the blister-mite is the outstanding pest and present in serious numbers, lime sulfur should be used at the rate of 1 to 10 or, if scale is present, 1 to 8. In orchards where the mite has not reached serious proportions and there are present such other pests as leaf roller and the brown aphid, an oil application of 8 to 100 is recommended. This must be applied only after the buds begin to crack slightly and preferably during warm, sunny weather."

Work with this mite by Parrot et al., in New York State, where it has been a serious enemy of the apple, has been noted (E. S. R., 20, p. 856), as has a short account by Quaintance (E. S. R., 35, p. 263).

The bionomics of the sarcoptic mange parasite of the buffalo, with some observations concerning the relative power of resistance to adverse conditions of the different stages of the acarus and of its egg, T. M. TIMONEY (*Agr. Research Inst., Pusa, Bul. 154 (1924), pp. 180-200, pls. 4*).—This is a reprint from the Proceedings of the Fifth Entomological Meeting held at Pusa, previously noted (E. S. R., 52, p. 154).

The author has found 17 or 18 to be the average number of eggs laid by an ovigerous female under experimental conditions, and 10 days to be the maximum duration of life of an egg-laying female. From 6 to 8 days was found to be the period between hatching and the attainment of adolescence.

"The ovigerous and pubescent females can withstand a longer separation from their host than can the other stages. The power of resistance to insulation is weakest in the male and small larvae. The nymph and large larvae occupy an intermediate position. The influence of sunshine in prolonging and the action of cold in curtailing the resisting powers of the acari were convincingly demonstrated. An exposure of 20 minutes to the action of a solution of 10 per cent creosote in olive oil, warmed to 31° C. (87.8° F.), killed all males, nymphs, larvae, and the majority of ovigerous and pubescent females. Tested by this acaricidal agent, the powers of resistance of the different stages corroborate the finding in regard to their resistance to more insulation. The incubative period is 1 to 2 days at summer temperature, and 2 to 3 days in winter. No egg separated for 5 days from the host hatched in the incubator (25-27°); and after 7 days at room temperature (10-13°) no egg hatched when subsequently placed in the host's body. Contact with 11 per cent creosote in olive oil for 30 minutes kills all eggs. Only a few survive an exposure of 20 minutes."

The "blinding filaria" of Guatemala (*Onchocerca caecutiens* Brumpt, 1919), F. FÜLLEBORN (*Jour. Amer. Med. Assoc., 83 (1924), No. 16, pp. 1269, 1270*).—The author discusses the transmission of *O. caecutiens*, which causes fibroma-like nodules on the scalp and is associated with certain chronic troubles of the eye (keratitis, etc.) in natives on the Pacific slopes of the volcanic ranges of Guatemala, in a narrow strip of country at an altitude between 600 and 2,000 meters (1,968 to 6,560 ft.). In some places 97 per cent of the population are affected. It is suggested that the nematode is transmitted by arthropods.

Rat-bite disease in the United States with report of a case, G. C. SHATTUCK and M. THEILER (*Amer. Jour. Trop. Med., 4 (1924), No. 5, pp. 453-460*,

fig. 1).—The authors report that, so far as they are able to determine, the case here reported is the first for the United States in which the presence of *Spirochaeta morsus-muris* has been demonstrated.

FOODS—HUMAN NUTRITION

On the constancy of the basal metabolism, G. LUSK and E. F. DuBois (*Jour. Physiol.*, 59 (1924), No. 2-3, pp. 213-216).—Basal metabolism data on 11 female dogs used in the extensive series of studies on animal calorimetry previously noted (*E. S. R.*, 52, p. 665) are summarized and discussed.

The average basal heat production amounted to 772 calories per square meter of body surface per day, with an accuracy of ± 15 per cent. In one dog upon which many basal metabolism experiments were conducted, the variation in basal metabolism during 17 experiments in two successive years was only ± 2.9 per cent. In general the basal metabolism of the dog was higher when returned from the country in the fall than after having been in the laboratory all winter.

The reported data on the basal metabolism of men include 12 different observations conducted on the junior author over a period of 11 years and 3 for the senior author in 1910, 1913, and 1924. In the former the minimum, maximum, and average results were 34.8, 40.6, and 37.7 calories per square meter of body surface per hour, the average variation being ± 7.6 per cent. In the latter the values for the 3 determinations were 42.8, 41.4, and 32.7. The authors are inclined to attribute the much lower value in the final determination to lack of exercise and indoor confinement corresponding to cage life in the dog.

A study of the effect of temperature on protein intake, W. DENIS and P. BORGSTROM (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 109-116, figs. 2).—An opportunity to compare the protein consumption of inhabitants of the semi-tropical portions of the United States with the general average for the whole country was afforded by data collected during a period of three years on the 24-hour excretion of total urinary nitrogen and creatinine by medical students at Tulane University, New Orleans. The material was obtained during the month of April, 1922, average temperature 22.94° C. (73.3° F.); April, 1923, temperature 21°; July, 1923, temperature 26.77°; and in February and March, 1924, temperature 13.05°. Reliable data were obtained on 233 men and 9 women, most of whom were between 18 and 22 years of age.

The average, maximum, and minimum figures obtained on the women subjects were urinary nitrogen 7.72, 10.62, and 4.05 gm.; creatinine coefficient 7.37, 8.5, and 5.97; and body weight 55.5, 65.91, and 45 kg., respectively.

For the male subjects, the average urinary nitrogen was 10.63 gm., or 11.07 gm. per 70 kg. man equivalent, and the creatinine coefficient 8.93, or 9.3 per 70 kg. On the assumption that 10 per cent of food protein is lost in the feces, the total average protein intake of the group was 73.8 gm. as compared with 121 gm. as the average protein intake for the United States according to Pearl, and 150 gm. according to the Atwater standard. By season, the lowest average of urinary nitrogen was 9.43 gm. in the summer and the highest 11.18 gm. in the cold weather in the spring of 1924, thus pointing to a seasonal influence. On grouping the subjects according to the places of residence, those coming from the Northern States showed an average excretion of about 2 gm. more than those coming from the Southern States.

"The results obtained furnish evidence in favor of the view that increase of temperature is accompanied by a decrease in protein intake, and that, apart

from the variations due to seasonal changes, the inhabitants of the semitropical portions of this country probably consume an amount of protein considerably below the quantity reported as the average intake for the Nation."

The biological value for maintenance and growth of the proteins of whole wheat, eggs, and pork. H. H. MITCHELL and G. G. CARMAN (*Jour. Biol. Chem.*, 60 (1924), No. 3, pp. 613-620, fig. 1).—Using the methods previously described (E. S. R., 51, p. 407), the authors have determined the biological values of the proteins of eggs, pork, and wheat.

A litter of 9 rats, weighing from 70 to 80 gm. each, was divided into two groups, the first group of 5 receiving the different rations in the order of protein-free, wheat, egg, pork, and protein-free, and the other group protein-free, egg, pork, wheat, and protein-free. The feeding periods were of 10 days' duration, the feces and urine of the last 7 days being used.

When fed at an 8 per cent level of intake, the average biological values found were eggs 93, pork 74, and wheat 67. The net protein values of the three foods, as calculated from average determinations of the crude protein content and the percentage losses in digestion and metabolism, were 12.5, 14.6, and 7.6 per cent, respectively.

Considerable and consistent individual differences were noted among the individual rats in the utilization of the dietary nitrogen, but the order in which the different foods were tested had no appreciable effect on the results obtained.

Biological food tests.—VII, The vitamin A and B content of fresh and dehydrated pumpkin. A. F. MORGAN and L. D. FRANCIS (*Amer. Jour. Physiol.*, 69 (1924), No. 1, pp. 67-77, figs. 2).—Using methods employed in previous papers of the series (E. S. R., 51, p. 666), the authors have investigated fresh and commercially dehydrated pumpkin for their content of vitamins A and B. Mice were used for the experiments on the vitamin B content of both fresh and dehydrated pumpkin, and rats for the vitamin A and vitamin B content of the dehydrated pumpkin.

As the sole source of vitamin B, the minimum amount of pumpkin flour for the normal growth of mice was from 0.5 to 0.6 gm., and for rats 1 gm. daily was necessary to restore normal growth after decline on a vitamin B-deficient diet. Of fresh pumpkin, an amount furnishing 0.4 gm. of solids daily was required for the normal growth of mice. As judged by the experiments with mice, pumpkin is considered to have a vitamin B potency of one-fifth to one-sixth in the dehydrated form, and one-fourth in the fresh form, of dry brewery yeast. As judged by the rat experiments, the potency of the dehydrated pumpkin is from one-third to one-fourth that of dry brewery yeast.

As a source of vitamin A for young rats suffering from a deficiency in this vitamin, 2 gm. daily was required, while 1 gm. was sufficient in protective experiments.

Antirachitic properties imparted to inert fluids by ultraviolet irradiation. A. F. HESS and M. WEINSTOCK (*Jour. Amer. Med. Assoc.*, 83 (1924), No. 23, pp. 1845, 1846).—It is reported briefly that cottonseed oil and linseed oil, irradiated in thin layers for an hour at a distance of 1 ft. from a quartz mercury vapor lamp, acquired antirachitic properties for rats, as shown by protective tests. The irradiated oils differed but little in iodine number from the corresponding untreated oils, but had a slightly higher total acidity. It is of interest that the oils on irradiation frequently acquired a somewhat fishy odor similar to that of cod liver oil.

Liquid petrolatum irradiated in a similar manner, water containing small amounts of radium bromide, linseed oil containing a minimal amount of radium, and ozonated water were all without protective properties.

Antirachitic properties imparted to inert fluids and to green vegetables by ultra-violet irradiation, A. F. HESS and M. WEINSTOCK (*Jour. Biol. Chem.*, 62 (1924), No. 2, pp. 301-313).—In addition to the materials noted above as capable of being rendered antirachitic by irradiation, wheat grown in the light and irradiated during growth and irradiated lettuce leaves were found to have antirachitic properties, while wheat grown in the dark and non-irradiated lettuce leaves were without effect. With cream, milk, gelatin, and human serum irregular results were obtained.

The influence of light in relation to diet on the formation of teeth, M. MELLANBY (*Brit. Dental Jour.*, 45 (1924), No. 9, pp. 545-552, figs. 3).—In continuation of the author's studies on the influence of diet on teeth formation (*E. S. R.*, 41, p. 858), 5 puppies in the same litter were fed a basal diet consisting of from 250 to 300 cc. of separated milk, 5 gm. of yeast, from 10 to 20 gm. of lean meat, from 1 to 4 gm. of common salt, and from 3 to 5 cc. of orange juice. Two of the puppies received in addition from 30 to 50 gm. of oatmeal and 10 cc. of olive oil, 2 others from 45 to 100 gm. of oatmeal and 10 cc. of olive oil, and the remaining puppy from 45 to 100 gm. of oatmeal and 10 cc. of cod liver oil. The animals were all kept in the dark, but one of the first and one of the second groups received ultraviolet radiations daily. After a period of 5 months the animals were killed and their teeth photographed and examined.

The most perfect teeth were those of the fifth dog, the worst with respect to calcification and dentine the one on the second diet without light treatment, and only slightly better the other dog on the same diet with light treatment. Of the two in the first group, the one receiving light treatment had decidedly the better teeth.

The effect of diet on the development and extension of caries in the teeth of children, M. MELLANBY, C. L. PATTISON, and J. W. PROUD (*Brit. Med. Jour.*, No. 3322 (1924), pp. 354, 355).—The effect of diets similar in essential constituents to the above on the development of dental caries in children was tested on three groups of children of the same age. One group of 9 received a diet which included cod liver oil, milk, and eggs, but no oatmeal; a second group of 10 a diet including oatmeal, very little egg, less milk, and no cod liver oil; and a third group of 13 children was chosen from patients on ordinary hospital diet which was intermediate between the other two with respect to its power to aid calcification. The effect of these diets on general health and on the condition of the mouth and teeth was watched, and an examination was made at the end of the experiment, which lasted about 8 months, of the carious teeth which had been extracted.

While no difference could be noted in the general health of the children in the three groups, there was a marked difference in the extent of the spread of caries. On the first diet the average number of teeth per child in which caries had spread was 1.4, on the second 5.1, and on the third 2.9. The diet giving the best results was rich both in calcium and vitamin A and contained comparatively little cereal.

The relation of calcium and phosphorus in the diet to the absorption of these elements from the intestine, W. J. ORR, L. E. HOLT, JR., L. WILKINS, and F. H. BOONE (*Amer. Jour. Diseases Children*, 28 (1924), No. 5, pp. 574-581).—Metabolism studies, using the procedure previously described (*E. S. R.*, 50, p. 669), were conducted on two subjects, a child with incipient rickets and another who had recovered from a mild nutritional disturbance. The calcium and phosphorus intake and output of these children were determined on a normal diet, a high calcium diet, and a high phosphorus diet, with suitable

intervals between the three periods of study. Determinations were also made of the calcium and phosphorus of the blood serum.

The results obtained showed that excessive amounts of calcium in the diet tend to increase the total absorption and retention of calcium and to decrease the retention of phosphorus. Following an excessive intake of phosphorus, the actual amount of phosphorus retained is not increased and may be somewhat diminished, although its concentration in the blood serum is definitely increased. This is accompanied by a marked decrease in the amount of calcium retained, an increase in the calcium of the feces, a decrease in the calcium in the urine, and in one case a decrease in the concentration of calcium in the serum.

In discussing these results, it is concluded that "the retention of one element in the intestine by an excessive amount of the other in the diet is best explained by the formation of insoluble phosphates of calcium which can not be absorbed."

The effect of heat treatment of milk feedings on the mineral metabolism of infants, A. L. DANIELS and G. STEARNS (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 225-240, figs. 2).—The results previously obtained in the comparative study of the growth of young rats on milk pasteurized by the hold method and milk heated quickly to boiling (*E. S. R.*, 44, p. 860) have been confirmed in the case of a number of apparently well babies, whose weight remained stationary during a considerable period on pasteurized milk feedings but who gained promptly when the milk was changed to quickly-boiled milk. It is noted, however, that changes in the method of heating the milk did not result in growth stimulation in all of the babies under observation.

A further comparison was made of the relative value of the two methods of heating milk by conducting metabolism experiments on normal boy babies from 3 to 7 months of age. The pasteurized milk mixtures were prepared by heating milk in the feeding bottles at 145° F. for 30 minutes and the boiled milk by bringing it quickly to the boiling temperature three times in an aluminum pan over a gas flame, the whole process requiring about 8 minutes. Data are reported on the metabolism of nitrogen, calcium, and phosphorus in 6 subjects, 3 on one period of each form of milk and 3 on two alternating periods of each.

In all cases there was an appreciable increase in the retention of CaO and P₂O₅ on the boiled milk, and in all but two cases this was accompanied by increased nitrogen retention. The excretion of calcium in the feces was greater on the pasteurized than on the boiled milk. The urinary calcium did not run parallel with the fecal. In the case of the phosphorus the amount excreted by the urine was higher and more consistent on the pasteurized milk than was that of the feces. The fecal nitrogen was not consistently greater during the pasteurized milk period, but the urinary nitrogen was higher. "It is probable that a baby fed pasteurized milk over a long period of time is receiving too little calcium for his growth needs."

Studies on carbohydrate metabolism.—I, Variations in the nature of the blood sugar, L. B. WINTER and W. SMITH (*Roy. Soc. [London], Proc., Ser. B*, 97 (1924), No. B 680, pp. 20-40, figs. 3).—In the investigation reported in this paper a comparison was made of the nature of the sugar in normal and diabetic blood as determined by the ratio of the observed optical rotation (*P*) to that calculated from the reducing power of the carbohydrate on the basis that glucose is the only reducing substance present, this factor being referred to as *C*.

As shown in a previous investigation (*E. S. R.*, 49, p. 715), the ratio *P:C* is low in normal blood. In diabetic blood the ratio was found to be abnormally

high. On subjecting equal quantities of sugar solution from diabetic blood to mild and strong hydrolysis, respectively, a large increase in the value of P and no change in C occurred following mild hydrolysis, while after strong hydrolysis the values of P and C corresponded to α - and β - glucose in equilibrium. This is thought to indicate that "there is in diabetic blood a mixture of sugars, some of which are of considerable complexity. These may be changed as a result of mild hydrolysis to simpler and more strongly dextro-rotatory substances which are devoid of reducing action. The value of C was accordingly not increased with this treatment."

When normal blood sugar was subjected to mild hydrolysis the value of P did not rise above that of C . This was also true with the blood sugar of diabetic patients following insulin treatment, thus suggesting that the first change in the blood sugar due to insulin is the removal or breaking down of abnormal complex constituents. An examination of the blood sugar of rabbits following injection of adrenalin and thyroid extract alone gave results similar to those obtained with diabetic blood. The injection of thyroid and adrenalin together caused an increase in the total blood sugar but no change from the normal.

The blood sugar of normal rabbits after insulin injections gave positive values for P but no results for C . After prolonged hydrolysis only the faintest traces of reducing sugars were present. These results are thought to point to the presence of a very resistant type of carbohydrate. The blood sugar of a rabbit killed after recovery from insulin convulsions gave a small but appreciable value for C .

In discussing these results the apparently paradoxical effects of insulin on normal and diabetic blood are explained somewhat as follows: A normal dose of insulin given to a diabetic enables him to form a complex sugar of the nature of glycogen, which, on account of the need of the tissues for a reactive sugar, is broken down immediately. The presence of this reactive sugar in the blood is shown by the alteration in the ratio $P:C$. In the normal animal in which the pancreas is functioning the insulin converts all of the normal utilizable sugar into a stable form which is resistant to hydrolysis by acids. The lack of a reactive form of sugar is considered to prevent not only the normal metabolism of carbohydrate but also that of fat.

Studies on carbohydrate metabolism, II, III, H. B. HUTCHINSON, W. SMITH, and L. B. WINTER (*Biochem. Jour.*, 17 (1923), No. 6, pp. 683-692, 764-767, fig. 1).—In continuation of the investigation noted above, two papers are presented.

II. *On the preparation of an antidiabetic hormone from yeast*, I (pp. 683-692).—The results are reported of various attempts to obtain glucokinase from yeast by the method for the preparation of insulin devised by Collip and modified by Dudley (*E. S. R.*, 49, p. 803).

In the first series of experiments fresh bakers' yeast was used as the foundation material. The extract obtained caused less local irritation than insulin when injected into rabbits. Much larger amounts were required than of insulin to lower the blood sugar to the same level, but the action was considerably prolonged. Modifications of the process were found to produce no appreciable difference in the activity of the product obtained from a given sample of yeast, but different samples of yeast appeared to contain widely differing amounts of the substance. The presence or absence of phosphates alone affected the yield from any given variety of yeast.

The authors are of the opinion that by the selection of suitable yeasts a genuine antidiabetic hormone can be obtained, but that only in the case of an originally active yeast is it possible to increase the glucokinase formation.

III. *On the formation of an antidiabetic hormone by the action of a bacillus (preliminary communication)* (pp. 764-767).—From a culture of yeast containing a small amount of glucokinase, as tested in the above study, a pure culture of a coliform bacillus was obtained which, on cultivation in peptone water containing 1 per cent glucose and 1 per cent Na_2HPO_4 or NaH_2PO_4 and subsequent extraction, also yielded an insulin-like substance. The active substance resembled that obtained from yeast in that the same delayed action was obtained on injection in rabbits. The organism, which has not as yet been identified, produces acid and gas from glucose or lactose in 12 hours and does not liquefy gelatin.

Some effects of insulin on the carbohydrate and phosphorus metabolism of normal individuals, N. R. BLATHERWICK, M. BELL, and E. HILL (*Jour. Biol. Chem.*, 61 (1924), No. 1, pp. 241-259, figs. 3).—The recent literature on the connection between carbohydrate and phosphorus metabolism is reviewed, and additional evidence is presented in support of the theory that a compound of hexose with phosphoric acid is an intermediate product in carbohydrate metabolism.

The evidence was obtained along two lines. Determinations were made of the changes in the sugar and inorganic phosphorus of the blood and urine resulting from the ingestion of glucose following the injection of insulin, and from the injection of increasing amounts of insulin in connection with a standard diet.

The injection of insulin in normal subjects before the ingestion of glucose causes a marked decrease in the inorganic phosphorus of the blood plasma at the time of hypoglycemia. This was accompanied by a decrease in the excretion of phosphorus in the urine. When insulin was injected in increasing amounts in connection with a uniform basal diet there was an increase in the excretion of phosphorus for one or two days, accompanied by an increased elimination of nitrogen. With continued administration of insulin the excretion of both phosphorus and nitrogen decreased until values lower than normal were obtained. Insulin tended to cause a decrease in the excretion of phosphorus during the day and an increase during the night. "It may be assumed that these effects are produced by inorganic phosphorus being withdrawn from the blood to form the hexose phosphate combination in the other tissues, and when the effects of the insulin have been spent this compound breaks up, thus releasing phosphate into the blood and thence into the urine."

Methods of including intarvin and glyceryl margarate in the diabetic diet, M. S. REYNOLDS and A. L. MARLATT (*Jour. Home Econ.*, 16 (1924), No. 12, pp. 692-700).—This contribution from the home economics department of the University of Wisconsin reports a study of various methods of combining intarvin or glyceryl margarate with food materials suitable for diabetic patients to obtain palatable products. The preparations tested included bran cakes, cooked combinations with tomatoes or other vegetables, salads, frozen desserts, and highly seasoned sauces.

The most palatable products proved to be those in which tomatoes were used and various vegetable salads. "Two general rules may perhaps be laid down for introducing intarvin and glyceryl margarate into a palatable diet: (1) Whenever possible they should be used unmelted. (2) When used in hot foods they should be added immediately after the food is removed from fire, and the material should be served at once without reheating."

ANIMAL PRODUCTION

Report of analyses of samples of feeding stuffs collected in New York State from July 1 to December 31, 1923, inclusive (N. Y. State Dept

Farms and Markets, Agr. Bul. 167 (1924), pp. 138).—This consists of the guaranties and analyses for protein, fat, and fiber of the samples of feeding stuffs collected in New York State from July 1 to December 31, 1923.

Report of the departmental committee on the Fertilizers and Feeding Stuff Act, 1906, LORD CLINTON ET AL. (*London: [Min. Agr. and Fisheries], 1924, pp. 63, pls. 2*).—This consists of the report of the committee appointed by the Minister of Agriculture and Fisheries to investigate the operations of the Fertilizers and Feeding Stuff Act of 1906, with suggestions for improvement.

Beef cattle feeding experiments, H. HACKEDORN, J. SOTOLA, and R. P. BEAN (*Washington Col. Sta. Bul. 186 (1924), pp. 4-26, figs. 6*).—This bulletin reports the results of three experiments in which the feeding value of corn and sunflower silage for steers was studied.

A study of the comparative feeding value of sunflower silage and corn silage in rations of steers.—In this experiment, which was conducted at the main station during the winter of 1921-22, corn and sunflower silage were compared for fattening 2-year-old steers. Two lots were fed for 75 days on 2 lbs. of cottonseed meal per head daily, and in addition lot 1 received a mixture of corn silage and chopped alfalfa hay (3:1), while lot 2 received sunflower silage and chopped alfalfa hay mixed at the rate of 3.5:1. The corn silage was slightly immature, due to early cutting on account of frost, but the Mammoth Russian sunflowers had well-developed seeds at the time of cutting. The average daily gains of the two lots were 1.2 lbs. and they were considered equally well finished. The sunflower lot consumed about 455 lbs. more silage per 100 lbs. of gain than the corn silage group, but less digestible nutrients were consumed by this lot. The efficiency of sunflower silage was calculated as 88 per cent that of corn silage on a pound basis.

A study of various proportions of silage to feed with hay and small quantities of grain [for long yearling steers].—This and the succeeding experiment were conducted at the Irrigation Substation during the winter of 1923-24. Three lots of 30 long yearling steers each were used in this experiment. All lots received 4 lbs. of cracked wheat daily per head and a full feed of alfalfa hay and corn silage. The proportions of the hay and silage fed in the different lots were 1:1 in lot 1, 1:2 in lot 2, and 1:3 in lot 3. The average daily gains of the three lots during the 60-day feeding period were, respectively, 1.75, 2, and 2.11 lbs. The feeds required per 100 lbs. of gain were 223 lbs. of cracked wheat, 882 lbs. of hay, and 888 lbs. of silage; 200 lbs. of cracked wheat, 605 lbs. of alfalfa hay, and 1,221 lbs. of silage; and 189 lbs. of cracked wheat, 489 lbs. of hay, and 1,578 lbs. of silage in the three lots, respectively. The rations containing the larger amounts of silage produced the cheaper gains and required less digestible nutrients per unit of gain, though all three rations were satisfactory.

A comparison of a hay-silage ration with one of hay for calves receiving shelled corn as the concentrate.—In this experiment a ration of shelled corn and alfalfa hay was compared with one of shelled corn, alfalfa hay, and corn silage for fattening calves. The average daily gains made during the 63-day test were nearly equal, being 2.08 lbs. on the former and 2.11 lbs. on the latter ration. There was little difference in the finish, but the group receiving silage had a glossier coat and shed sooner. Approximately 2.5 lbs. of silage replaced 1 lb. of hay. The silage ration as consumed supplied per day about 0.5 lb. less digestible nutrients than the hay ration.

The chemical composition and the digestibility of the feeds as obtained from other sources are also given.

Rations for fattening cattle, W. E. CARROLL (*Utah Sta. Bul. 192 (1925), p. 32*).—In a two years' study of the most efficient amount of grain to feed with

alfalfa hay for fattening cattle the gains of lots receiving alfalfa hay only and with 3, 5, 8, and 12 lbs. of grain per day, respectively, were compared.

When the rations included 3 lbs. of grain, each pound replaced 6.1 lbs. of hay, while gradual decreases in the amount of hay replaced per pound of grain occurred as more grain was added to the ration. Each pound of grain above 5 lbs. per day replaced only 2.1 lbs. of alfalfa hay when 8 lbs. of grain was fed.

In another test of rations consisting of alfalfa hay as a basis cattle receiving 9.4 lbs. of chopped barley gained 1.93 lbs. per head daily, and when corn silage was added to a ration of alfalfa hay and 4.8 lbs. of chopped barley the gain was 1.9 lbs. When wet beet pulp replaced the corn silage the average daily gain was 2.21 lbs. It was estimated that a ton of beet pulp replaced 1,100 lbs. of silage, 64 lbs. of chopped barley, and 150 lbs. of hay.

Kemp fibres in the Merino sheep, J. E. DUERDEN (*Union So. Africa Dept. Agr. Jour.*, 9 (1924), No. 2, pp. 167-170, figs. 3).—It is shown that kemp is the remnant of fibers of an outer coat on lambs at birth. The microscopical characteristics of kemp are described.

The 1925 wool clip, G. A. BROWN (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 79-81, fig. 1).—A popular discussion of the effect of various factors, including the care of the sheep, feeding, shearing, and tying of the fleece, on the quality of the wool produced. A diagram of a wool box is included.

Report on pig-feeding trials carried out at the County Council Farm, Hutton, 1920-1923, J. J. GREEN and R. RICHARDSON (*Lancaster Co. Council Ed. Com., Agr. Dept., Farmers' Bul.* 59 (1924), pp. 28).—The results of experiments conducted from October, 1920, to December, 1923, are briefly given. In determining the feed requirements per unit of gain the following succulent feeds have been considered as equal to 1 lb. of concentrates: 12 lbs. of whey, 8 lbs. of swedes or mangels, and 4 lbs. of potatoes.

The value of fish meal as a feeding stuff for pigs (pp. 6, 7).—In comparing the value of fish meal and corn meal for fattening pigs, twelve 14-weeks-old pigs averaging 58 lbs. were selected. The ration of one-half of the pigs consisted of 4 parts of sharps and 4 parts of corn meal, with from 1 to 1½ gal. of whey per day. The ration of the other half was similar except that 1 part of fish meal replaced 1 part of corn meal. The pigs receiving no fish meal developed lameness without exception, the first pig being affected at the end of 12 weeks. The average daily gains of the two lots up to this time were 0.9 and 0.83 lb., respectively, for the lots receiving fish meal and no fish meal. It became necessary to kill three of the pigs in the no-fish-meal lot, but by adding fish meal to the ration of the other three pigs the lameness gradually disappeared, probably due to the mineral content of the feed. Not only did the addition of fish meal produce more rapid gains and prevent lameness but the lot receiving this feed required 0.35 lb. less feed to produce 1 lb. of gain than the other lot.

The value of fish meal and of oatmeal in pig feeding (pp. 8-11).—Three lots of six pigs each averaging about 40 lbs. in weight were selected for this experiment. The ration fed to lot 1 consisted of 3 parts of sharps, 3 parts of palm kernel cake meal, 4 parts of corn, and 1 to 1½ gal. of whey per pig daily. This ration was modified for lot 2 by the substitution of 1 part of fish meal for 1 part of corn, and it was further modified for lot 3 to consist of 3 parts of sharps, ½ part of corn, 1½ parts of barley meal, and 2 parts of oatmeal, with the same amount of whey as the other lots received. The average daily gains made by the different lots during the first three months of this feeding experiment were 0.85, 0.76, and 0.78 lb., respectively, 3.61, 3.88, and 3.73 lbs. of meal being required to produce 1 lb. of gain by the respective lots. During this time 2 pigs in lot 1 became lame, and 1 from lot 3 developed rheumatism. Lots 2

and 3 were continued for a second three months' period, lot 2 making average daily gains of 1.44 lbs. as compared with 1.24 lbs. by lot 3. The respective feed requirements per pound of gain were 4.37 and 4.60 lbs. The fish meal was discontinued six weeks prior to the end of this experiment, and the amount of oatmeal was increased in the other lot. There was practically no difference in the carcasses and dressing percentages of the two lots, but the flavor of the cooked bacon from lot 3 was found to be better.

Does fish meal taint pork or bacon? (pp. 12-14).—In testing the possibility of fish meal flavoring pork products, five pigs were fattened on a ration consisting of one-eighth fish meal. One animal received the same ration up until the time of slaughter, while the fish meal was discontinued at 1, 2, 4, and 6 weeks, respectively, prior to the slaughtering of the other animals. No fishy flavor could be detected in the pork or the lard, but such flavor was detected in the bacon of those receiving fish meal up to one and two weeks before slaughter. a distinctly unpleasant flavor was observed in the bacon of the pig receiving fish meal until slaughtering occurred.

The value of whey for pig feeding (pp. 15-18).—In this experiment three rations were compared for fattening 10-weeks-old pigs averaging about 50 lbs. at the beginning of the test—lot 1, 6 parts of sharps, 4 parts of corn, and $\frac{1}{2}$ to 1 gal. of water per pig per day; lot 2 the same as lot 1, except for the substitution of an equal amount of whey for the water; lot 3 the same as lot 1, except for the substitution of 1 part of fish meal for 1 part of corn. During the first 20 weeks the average daily gains of the three lots were 0.55, 0.84, and 0.81 lb., respectively. It was found necessary to add a mineral mixture to lot 1 as the pigs developed lameness at the end of 10 weeks. The fish meal was discontinued from the ration of lot 3 at the end of the 20 weeks, and the three lots were continued for a determination of the further gains. Lots 1 and 3 receiving the same ration made average gains per pig per day of 1.5 and 1.4 lbs., while lot 2 made gains of 1.6 lbs. per day. During the first six months of the experiment the whey-fed pigs appeared more thrifty and gained better, but later the pigs receiving meal only recovered a large part of this advantage.

The value of palm kernel cake meal for pig feeding (pp. 19, 20).—In this experiment 4 parts of sharps were compared with 4 parts of palm kernel cake meal in a ration consisting, in addition, of corn meal 3 parts and fish meal 1 part, with 1 to $1\frac{1}{2}$ gal. of whey per pig daily.

The experiment lasted from January 11 to the end of July. The two lots of pigs, averaging 83 and 84 lbs. per head, made average daily gains of 1.32 lbs. and 1.42 lbs. on the sharps and palm kernel cake meal rations, respectively. The feed requirements to produce 1 lb. of gain were 4.97 and 4.76 lbs.

The author concludes that palm kernel cake meal has proved a satisfactory substitute for sharps and is more economical.

Wet v. dry feeding of pigs (pp. 21-23).—In an 18 weeks' experiment using two lots of 140-lb. pigs, one lot received a mixture of concentrates steeped in whey, while another lot received the same mixture in self-feeders, with an equal amount of whey fed separately. Average daily gains of 1.62 and 1.61 lbs. per head were made by the two methods of feeding. Slightly more feed, however, was required per pound of gain by the self-fed lot, i. e., 4.49 lbs. as compared with 4.37 lbs.

Since the feeding in the above experiment was done inside, a further test was conducted outdoors with pigs weighing about 50 lbs. During the $5\frac{1}{2}$ months of the outdoor test the average daily gains of the self-fed lot exceeded those receiving the wet feed by from 0.1 to 0.36 lb. per day, but when the pigs were moved inside for a period of two weeks the reverse was true. The self-fed lot consumed more feed, but required 0.31 lb. less feed to produce 1 lb. of gain.

Outdoor v. indoor pig keeping (pp. 24-27).—Two lots of similar pigs averaging about 145 lbs. in weight were used for comparing inside v. outside methods of fattening. Each lot gained an average of 1.64 lbs. per day during the nine weeks, though the indoor-fed lot required 7.6 lbs. of feed per pound of gain as compared with 8.23 lbs. by the outdoor-fed lot.

In a second experiment the pigs selected were about 12 weeks old, averaging 52 and 51 lbs., respectively, in the two lots. During the first two months, June and July, the average daily gain made by the outdoor lot was 1.02 lbs., as compared with 0.9 lb. by the indoor lot, while during August and September the gains of the respective lots were 1.14 and 1.22 lbs. and during October and November 1.22 and 1.39 lbs. Due to weather conditions the outdoor lot was transferred to a piggery during two weeks in December, when the gains of the outdoor and indoor lots, respectively, were 1.63 and 1.57 lbs. The outdoor lot required 0.53 lb. more feed to produce 1 lb. of gain than the lot fed indoors. It is concluded to be more profitable to fatten pigs indoors during the autumn and early winter.

Relation of weight of pigs to food consumed and rate of gain (p. 28).—From the records of three years' experiments a table has been computed to show the average feed consumption, daily gain, and feed required to produce 1 lb. of gain in pigs of varying weights.

Hog rations, W. E. CARROLL (*Utah Sta. Bul.* 192 (1925), p. 31).—In comparing various rations for fattening swine in a 56-day test, the average daily gains and feed requirements per 100 lbs. of gain were as follows: Lot 1 1.55 lbs., requiring 22 lbs. tankage and 414 lbs. rolled barley; lot 2 1.42 lbs., requiring 33 lbs. tankage and 411 lbs. shelled corn; lot 3 1.18 lbs., requiring 124 lbs. bran, 251 lbs. shorts, and 634 lbs. buttermilk; and lot 4 1.23 lbs., requiring 422 lbs. rolled barley and 8 lbs. of alfalfa hay.

In another test, in which purebred Tamworths were fed for 82 days having access to alfalfa hay in racks, the efficiency of various methods of feeding barley was studied. Whole barley was 19 per cent less efficient than chopped barley and 22 per cent less efficient than rolled barley, while rolled barley was about 2.5 per cent more efficient than chopped barley.

Self-feeders for hogs: Their construction and directions for self-feeding, G. BOHSTEDT and W. L. ROBISON (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 11-12, pp. 210-221, figs. 6).—This is a discussion of the construction of self-feeders and directions for their use in winter and summer feeding, including suggested mixtures for self-feeding pigs of various ages.

Swine production, E. Z. RUSSELL (*U. S. Dept. Agr., Farmers' Bul.* 1437 (1925), pp. II+30, figs. 18).—This discusses the hog raising industry in the United States and points out the general principles to be observed in the care, management, breeding, and feeding of swine. It supersedes Farmers' Bulletin 874 (*E. S. R.*, 38, p. 169).

Textbook of swine production, F. DETTWEILER and K. MÜLLER (*Lehrbuch der Schweinezucht*. Berlin: Paul Parey, 1924, pp. XV+918, figs. 381).—This book discusses the various phases of swine production in much detail. Chapters are included on anatomy and physiology, selection and judging, origin of the domesticated swine races, the European breeds of the present day, breeding, feeding, management, slaughtering, and State and private agencies for the improvement of swine. An extensive discussion of swine diseases is given by W. Pfeiler in a chapter of 350 pages.

Feeding work horses, M. W. HARPER (*New York Cornell Sta. Bul.* 437 (1925), pp. 3-59).—This bulletin reports the results of comparisons of various rations for feeding work horses, which were in progress from November 9,

1910, to September 9, 1918. In conducting the tests the teams were divided so that one horse received one ration while the other horse received the contrasting ration for a test period, and in most of the tests a second period followed in which the rations were reversed. A recuperation period followed each test period, during which both horses of a team received a grain ration of half corn and half oats.

Records were kept of the feed consumption, monthly weights, hours of labor, condition and spirit of the animals, residual effect, and economy of the rations. The greater part of the work consisted of a comparison of oats and corn when fed with timothy hay. The grains were fed ground, whole, singly, and in combinations. All animals received a warm bran mash on Saturday nights. The main results of the experiments are summarized in the following table, which shows the kind and amount of grain and hay consumed per 1,000 lbs. live weight and the average gain or loss in live weight and the number of animals in poor condition during each experiment:

Comparison of oats and corn for work horses

Ex- peri- ment	Grain ration	Length of test period	Average gain	Average daily ration per 1,000 pounds live weight		Animals in the experiment	
				Grain	Timothy hay	Num- ber	Num- ber in poor con- dition
		<i>Mos.</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>		
1	Whole oats.....	6	-38.3	12.0	14.5	6	4
	Ground oats and corn meal 1:1.....	6	+22.5	11.6	13.8	6	1
2	Whole oats and shelled corn 1:1.....	7	-38.4	12.1	14.8	5	3
	Ground oats and corn meal 1:1.....	7	+25.8	12.0	15.4	5	1
3	Ground oats.....	6	-15.6	12.7	15.4	5	2
	Ground oats and corn meal 1:1.....	6	+17.4	12.7	15.3	5	1
4	Corn meal and wheat bran 9:1.....	6	-5.0	11.9	14.1	5	1
	Ground oats and corn meal 1:1.....	6	+16.0	11.0	13.4	5	1
5	Ground oats.....	3	+2.5	11.7	14.4	6	0
	Whole oats and shelled corn 1:1.....	3	-12.5	12.3	14.9	6	2
6	Hominy, wheat feed, and oil meal 4:4:1.....	4-6	+23.0	12.5	14.6	10	1
	Hominy and ground oats 1:1.....	4-6	+19.0	12.5	15.2	10	0
7	Ground oats and hominy 1:1.....	6	+33.7	12.6	14.3	8	0
	Ground oats and corn meal 1:1.....	6	+18.7	12.5	14.2	8	1
8	Whole oats.....	6	-17.2	12.9	14.3	9	4
	Whole oats and shelled corn 1:1.....	6	-18.9	12.5	13.7	9	4
9	Ground oats and hominy 1:1.....	3	+12.1	12.8	12.8	12	1
	Ground oats and corn meal 1:1.....	3	+9.2	13.1	13.2	12	2
10	Whole oats.....	3	+2.7	12.8	12.8	11	2
	Ground oats.....	3	+9.5	12.6	12.7	11	1
11	Whole oats and hominy 1:1.....	6	+19.5	12.7	13.1	10	0
	Ground oats and hominy 1:1.....	6	+40.5	12.5	12.9	10	0

The effects of the different rations were discussed with reference to health, spirit, and appetite of the animals. There was some irregularity among different horses, due to individuality and amount and kind of work, but it generally followed that "when the work was light or irregular in amount, oats, either whole or ground, gave good results, but when the work was severe and regular, continuing day after day, the addition of hominy or corn meal to the ration gave much better results."

Three other experiments are also reported in this bulletin in which the general methods of feeding were similar to those employed in the comparisons of oats and corn. In one of these experiments the usual ration of 15 or 18 lbs. of grain (ground oats and corn meal) and 16 or 18 lbs. of timothy hay was re-

placed by one containing two-thirds the amount of grain in the first test and three-fourths the amount of grain in the second test, with a sufficient increase in the hay to supply the same amount of total digestible nutrients. These tests were conducted by the reversal method, the first one being 112 days in duration and the second 100 days. In both tests the regular ration was found superior to the one containing less grain in its ability to maintain weight, spirit, endurance, and physical condition in the horses. High relative prices of grain as compared with hay, however, might make a reduction in the proportion of the grain in the ration desirable.

In another experiment consisting of three test periods of 52, 77, and 105 days in duration, long timothy hay was compared with timothy hay cut in about 0.5 in. lengths and fed with the grain. The horses receiving chopped hay consumed 0.3 lb. less hay and 0.3 lb. more grain per 1,000 lbs. of live weight than the other group. Chopped hay produced somewhat greater gains in body weight, and the general conditions of the horses seemed to be slightly superior.

In an experiment of 29 days' duration, alfalfa hay was compared with timothy hay and it was found that the horses receiving alfalfa hay required 0.6 lb. less grain and 0.6 lb. less hay per 1,000 lbs. of live weight, though they excelled their team mates in gains in weight, spirit, endurance, and in physical condition.

Alfalfa and horses, R. S. HUDSON (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 75-79, fig. 1).—The results of the comparative feeding trials with rations of oats, corn, and timothy, and corn and alfalfa, in continuation of those previously reported (*E. S. R.*, 52, p. 570), are given. These trials carried the animals through the summer and fall. The results were very similar to those reported for the winter and spring, corn and alfalfa proving equal or slightly superior in maintaining weight, while the cost was less. The combined results of the four periods are summarized.

The biology of the fowl, E. EVANS (*Burnley, Eng.: John Dixon, Ltd.*, 1923, pp. 160, figs. 18).—The anatomy and physiology of the fowl are briefly discussed in relation to practical feeding, management, and breeding of poultry.

On the length and variability of the bones of the White Leghorn fowl, M. SCHNEIDER and L. C. DUNN (*Anat. Rec.*, 27 (1924), No. 5, pp. 229-239).—The usual biometrical constants have been calculated for the length and width of the cranium and the length of the humerus, ulna, femur, and tibia from the right side of 350 adult Single Comb White Leghorn females and 46 adult males which have not been closely inbred.

It was found that the variability was similar to that in other animals for like measurements and much less than for body weights in birds. The correlations between the different measurements as determined for the females were very high, ranging from 0.562 ± 0.049 to 0.943 ± 0.004 .

The constants obtained from this study are to be used in future investigations of the effect of inbreeding on the body size of White Leghorns at the Connecticut Storrs Experiment Station.

Postnatal growth of the body, systems, and organs of the Single-Comb White Leghorn chicken, H. B. LATIMER (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 8, pp. 363-397, figs. 31).—This paper reports the results of an investigation at the Minnesota Experiment Station of the rate of postnatal growth of Single Comb White Leghorns from hatching to about 300 days of age, based on periodical live weights and the measurements and weights of various parts of the body and organs of over 100 birds killed at various ages.

The data obtained from the autopsies included weights of the dead animal, head, feathers, skin, comb and wattles, digestive tube full and empty, gizzard,

stomach, esophagus, crop and intestines, yolk sac, liver, pancreas, trachea and lungs, heart, thyroids, thymus, spleen, suprarenals, hypophysis, kidneys, ovaries and oviducts, testes, ligamentous skeleton, skeletal muscles, brain, spinal cord, and eyeballs, and measurements of the body length (tip of bill to anus), height (back to toe), left leg length (tip of toe to greater trochanter), left wing (tip of wing to proximal end of humerus), length of head, and dorsoventral and transverse diameter of the thorax.

The data are presented in the form of smoothed curves of both sexes, showing the relation of the different sizes of the body and organs to age and to body weight. The curve of growth in the chicken shows three phases, i. e., (1) a period of slow growth that includes a brief postnatal decrease, (2) a period of rapid growth, and (3) a period of slow growth. A similar type of growth was also found for the muscles, ligamentous skeleton, digestive tract, lungs, heart, kidneys, suprarenals, and integument. Sex differences were shown very soon after the beginning of the rapid growth period. The author has pointed out the peculiarities of the different curves.

Poultry [experiments at the Utah Station], B. ALDER (*Utah Sta. Bul.* 192 (1925), pp. 61, 62).—Progress reports on several experiments with poultry are given.

Breeding for egg production.—In endeavoring to produce a strain of fowls that will be heavy layers over a period of three years, a few outstanding individuals have been developed. One hen has produced 1,054 eggs, while others have produced over 600 eggs in three years.

A study of incubation problems.—In studying the time of hatching of birds with relation to their production it was found that April-hatched pullets gave slightly better results over a three-year period than pullets hatched in March, May, or June.

Poultry feeding.—The importance of protein feeds in addition to grain and mill by-products for egg production has been demonstrated, as well as the value of skim milk.

In other experiments, home-grown and home-mixed feeds have proved superior to corn and other imported and ready-mixed commercial feeds.

Rearing early chicks, C. G. CARD (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 81-83).—A popular account of the nutritional requirements of chicks raised in confinement, with special reference to the need of direct sunlight and vitamins.

The culling and feeding of poultry, B. F. KAUPP (*N. C. Dept. Agr. Bul.*, 1924, Aug., pp. 40, figs. 23).—Popular directions are given for culling, feeding, and managing poultry, with special reference to the results of experiments conducted at the North Carolina Experiment Station.

DAIRY FARMING—DAIRYING

The intrauterine development of the bovine fetus in relation to milk yield in Guernsey cattle, J. W. GOWEN (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 311-317).—This consists of a study of the effect of pregnancy on milk yields, based on the records reported in volume 31 of the Advanced Registry of the American Guernsey Cattle Club. Correlation coefficients between the 365-day milk yield and the duration of pregnancy, as determined by classifying the cows according to age in 6-months groups, varied from -0.021 ± 0.059 for cows of from 1.5 to 2 years of age to -0.275 ± 0.022 for cows of from 4 to 5 years of age and averaged -0.173 for cows of all ages, thus indicating a reduction in the milk yield as a result of carrying a fetus. The butterfat content of the milk was apparently not influenced by pregnancy.

Further studies indicated that the cows having a greater productive capacity are more frequently not bred during lactation, or are bred at a much later stage in lactation than are cows having a lower productive capacity. By making allowance for this condition, the partial correlations determined between the length of time the calf is carried and the milk yield of the mother were for the second, third, and fourth months of lactation for cows from 3 to 3.5 years of age -0.151 ± 0.028 , -0.112 ± 0.028 , and -0.099 ± 0.028 , and for cows from 3.5 to 4 years of age -0.183 ± 0.031 , 0.167 ± 0.031 , and -0.145 ± 0.031 , respectively. These constants thus indicate that even when the effect of the selection of cows of different productive capacities for early breeding is accounted for, there remains a significant correlation between the length of time the calf is carried and the milk yield of the mother.

Equations were also calculated for predicting the yearly milk yield, based on the monthly milk yield and pregnancy. The effect on the yearly milk yield of carrying a calf 9 months during lactation was found to reduce the yield from 342 to 628 lbs., which is equivalent to from 125 to 200 therms of energy.

The production of cow's milk having antirachitic properties [trans. title], LESNÉ and VAGLIANO (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 11 pp. 539-541).—Antirachitic properties were demonstrated for the milk and butter produced by a cow receiving 500 gm. of cod liver oil daily. Rickets occurred in young rats receiving butter from another cow, but this condition was cured when butter was supplied from the cow receiving the cod liver oil. The milk of this cow also tended to cure rickets in an infant.

Contribution to investigations of milk [trans. title], R. SCHMITT (*Milchw. Zentbl.*, 53 (1924), No. 1, pp. 1-5).—The specific gravity of the serum of milk was found in nearly all samples examined to decrease slightly when the milk coagulated.

Pasteurization of milk, G. L. A. RUEHLE (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, p. 114).—A brief description of the process, with reference to the resulting changes.

Fat droplets in pasteurized cream [trans. title], O. RAHN and W. MOHR (*Milchw. Forsch.*, 1 (1924), No. 5-6, pp. 363-373, figs. 5).—Cream pasteurized by the flash method was found to churn when going through a pump. A microscopic examination of cream pasteurized by the flash method at the dairy institute at Kiel showed that in this cream the fat droplets were much larger than in raw cream or in cream pasteurized by the holding process. Pasteurization at the high temperature was found to injure the butter-making qualities, as the yield was reduced and the amount of fat lost in the butter-milk was increased. Cream pasteurized by the holding process had practically the same characteristics as raw cream. The physical properties of the butter were not altered through pasteurization by either method.

Methods of dairy manufacture, G. WILSTER (*Utah Sta. Bul.* 192 (1925), pp. 35, 36).—Two experiments were conducted in dairy manufacturing.

Effect of clarification on quality of cheese.—In a study of the quality of cheese as determined by the average scores of several judges, cheese made from clarified milk had a slightly higher score both at 1 and 3 months of age, the difference being 0.38 at the former and 0.87 at the latter age.

Manufacture of butter from sweet cream.—In butter-making experiments higher scoring butter has been produced at the station from a good quality of sweet cream which has been pasteurized and ripened to a low acidity than has been made by 197 other creameries located in several of the Western States. It was demonstrated that butter of excellent quality can be made by pasteurizing sweet cream, holding it at churning temperature, which should be

from 2 to 4° F. lower than for churning ripened cream, followed by churning the cream in a hand churn for from 40 to 50 minutes with a little more vigorous agitation than when churning ripened cream at a higher temperature.

The water content of butter [trans. title], O. RAHN (*Milchw. Forsch.*, 1 (1924), No. 5-6, pp. 294-315).—The effect of the season, temperature and duration of the churning, acidity of the cream, pasteurization, size of the fat globules and butter kernels, melting point of the fat, and the washing, working, and salting of the butter on the water content of the butter has been reviewed from the works of several investigators. It is concluded that the water content is independent of the fat content of the cream, but the following factors tend to increase the water content of the butter: Full churn, short churning period, soft fat, long working, high acidity of the cream, long washing period especially with warm water, and large fat globules. The water content is also dependent on the kind of butterfat, churning temperature, pasteurization of the cream, and salt.

The air content of butter [trans. title], O. RAHN and W. MOHR (*Milchw. Forsch.*, 1 (1924), No. 3-4, pp. 213-221, fig. 1).—Determinations of the air in butter by melting the sample in water in an air-tight container and collecting the air set free in a vacuum tube above have been made of 290 samples of butter at the Dairying Institute at Kiel.

The average air content was 4.2 cc. per 100 gm. of butter, the variations being 0.97 to 8.38 cc. in the different samples. Individual dairies tended to produce butter having a rather uniform air content. The season of the year also affected the amount of air present, it being high from June to October. Various conditions of manufacture and the characteristics of individual milks also had some influence.

The air content of margarine [trans. title], O. RAHN and W. MOHR (*Milchw. Forsch.*, 1 (1924), No. 5-6, pp. 360-362).—Determinations of the air content of margarine by the method used for butter (see above) have indicated much variability in the samples, but the air content of margarine is in general considerably higher than that of butter. Some of the air may be removed by prolonged working, which does not injure margarine as it does butter.

The relation between yeasts and moulds and the keeping quality of butter, D. B. SHUTT (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 357-360).—Based on the changes in flavor and the mold and yeast counts of 21 samples of butter at the Manitoba Agricultural College, it was shown that the samples containing the lower counts tended to decrease less in flavor during the six months' storage at 10° F. than samples nearly free from yeasts and molds.

Farm ice cream making, P. S. LUCAS (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 105, 106).—Directions for making ice cream on the farm and formulas for three types.

Measuring quality in ice cream, R. C. FISHER and H. F. JUDKINS (*Jour. Dairy Sci.*, 7 (1924), No. 1, pp. 31-39).—Essentially noted (E. S. R., 51, p. 79).

Dry milk [trans. title], K. LENDRICH (*Milchw. Forsch.*, 1 (1924), No. 5-6, pp. 251-293).—The results of studies of the biological, physical, and chemical properties of raw, evaporated, and dried milk are given from the Hygienic Institute at Hamburg. The properties of the remade milk were much the same as raw milk, except that the acidity was considerably reduced by the condensation and drying process. The influence of storage, atmospheric moisture, and homogenization on the composition of the dried milk was also studied.

Sodium hypochlorite.—IV, The phenol coefficient and relative disinfecting power of sodium hypochlorite, H. F. ZOLLER and S. M. EATON (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 318-329).—Several organisms were used in determining the phenol coefficient of the disinfecting powers of sodium hypochlorite at the research department of the Nizer laboratories. The coefficients determined for sodium hypochlorite with the different organisms were as follows: Typhoid 233.3, tubercle bacilli 42.8, alkaligines 100, anthracis 160, *Bacterium neapolitanum* (coli) 200, gonococcus 280, and proteus 330. The H-ion concentration of the disinfectant apparently had no influence on the disinfecting properties at the concentrations used. Sodium hypochlorite was slightly superior to mercuric chloride when *B. neapolitanum* was used.

VETERINARY MEDICINE

Report on the Civil Veterinary Department (including the Insein Veterinary School), Burma, for the year ended the 31st March, 1924, A. BLAKE (*Burma Civ. Vet. Dept. Rpt.*, 1924, pp. [6]+31, pl. 1).—This report (E. S. R., 50, p. 77) includes an account of the occurrence of and control work with contagious diseases of livestock.

[Annual reports of the chief veterinary research officer of Kenya Colony for the years 1922 and 1923], J. WALKER and W. KEARNEY (*Kenya Colony Dept. Agr. Ann. Rpts.* 1922, pp. 67-103; 1923, pp. 43-62).—An extended report is given on the occurrence of diseases of livestock and the control work conducted.

Handbook of pharmacology including materia medica, B. N. GHOSH (*Calcutta: Hilton & Co.*, 1923, pp. XII+396).—This handbook, which is designed for students of pharmacology, contains a brief section on materia medica, followed by a longer section on pharmacology in which the drugs discussed are classified chiefly on the basis of the organs on which they have their main effect.

Critical tests of miscellaneous anthelmintics, M. C. HALL and J. E. SHILLINGER (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 7, pp. 313-332).—This is a report of critical tests of a number of drugs, consisting in their administration in definite known doses to animals, with subsequent collection for a suitable length of time of all worms passed and the post-mortem examination of the animals with the collection of all worms then present.

The work has shown that a mixture of carbon tetrachloride 3 parts, by volume, and chenopodium 1 part, at the rate of 0.3 cc. per kilogram, accompanied by 0.125 to 0.5 grain arecoline hydrobromide will maintain the rather high efficiency of 90 per cent against ascarids, but is considerably less efficacious against hookworms as compared with its constituents without the arecoline hydrobromide, removing only 46 per cent, and it fails entirely to remove tapeworms. The arecoline hydrobromide appears to diminish the efficacy of the other drugs against hookworms, possibly by its very rapid purgative action, purgation commonly occurring in from half an hour to an hour, and, so far as can be judged from two cases, the efficacy of the arecoline hydrobromide against tapeworms suffers a diminution from the presence of the two other drugs.

"Benzyl phenol proved only slightly anthelmintic for hookworms, removing only about 5 per cent of the hookworms present. Ethylene dichloride proved only slightly effective against hookworms when given at a dose rate equivalent to the therapeutic dose rate for carbon tetrachloride. Ferrous sulfate in large doses showed very little efficacy against whipworms, and is evidently not de-

pendably effective in single doses for removing these worms. Chenopodium intramuscularly failed to remove whipworms from two infested dogs. Intravenously it removed only one whipworm from each of two infested dogs, showing that the drug has some anthelmintic action when thus given, as Lambert had found, but also showing a lack of dependable action even in dangerous doses. Novarsenobenzol subcutaneously failed to remove any whipworms from the one dog on which the drug was thus tested. Intravenously in single dose to one dog and in two doses to another it failed to remove any whipworms. Tartar emetic in single dose intravenously to three dogs failed to remove any whipworms. A proprietary remedy for tapeworm in dogs removed only 9 per cent of the tapeworms present.

"Magnesium sulfate simultaneously administered with lethal doses of chenopodium to dogs protected them from the toxic effects of the chenopodium, three out of four animals surviving the dose. Hall has shown that castor oil or calomel will protect dogs against the toxic effects of lethal doses of such drugs as chenopodium and male fern, from which it appears that the protective action of magnesium sulfate is due not only to its salt action but also to its purely purgative action. Our experiments also show that magnesium sulfate simultaneously administered with therapeutic doses of chenopodium does not diminish the efficacy of the chenopodium against ascarids, and suggest that the same is true as regards effect on hookworms. The writers have previously shown that the magnesium sulfate simultaneously administered with carbon tetrachloride does not diminish the efficacy of this drug against hookworms.

"Carbon tetrachloride, given with magnesium sulfate, will remove hookworms and nodular worms from monkeys, but the exact efficacy is unknown. Carbon tetrachloride given to sheep in doses of 10 cc., followed immediately by 128 gm. of magnesium sulfate, shows 100 per cent efficacy against stomach worms, nodular worms, and small trichostrongyles. Previous evidence from other experiments indicates that it is also 100 per cent effective against hookworms. When thus administered with magnesium sulfate there is a marked increase in efficacy against tapeworms, this treatment removing 33 per cent of these worms instead of being almost entirely ineffective. . . .

"Arsenic in the 30-grain dose ordinarily recommended for worms in horses apparently failed entirely to remove any stomach worms, palisade worms, or cylicostomes from a horse. Copper sulfate (8 gm.) in solution apparently failed entirely to remove any stomach worms, palisade worms, or cylicostomes from a horse. Novarsenobenzol intravenously for 4 days for a total amount of 14.4 gm. failed to kill strongyles (*Strongylus vulgaris*) in a verminous aneurism in a horse."

A list of 43 references to the literature cited is included.

The wandering of certain nematode larvae in the body of their hosts, [F.] FÜLLEBORN (*Jour. Parasitol.*, 11 (1924), No. 2, pp. 98, 99).—This is an abstract of an address delivered by the author in Baltimore in November, 1923, an earlier account of which work has been noted (*E. S. R.*, 48, p. 680).

The author's investigations, now in progress, indicate that with *Oxyuris* (*Enterobius*) *vermicularis* there is no migration in the liver and lungs, and that *Enterobius* can, perhaps, reproduce in the intestine of its host in the same way as does *Rhabditis hominis*.

Chemical changes in the blood and their clinical significance, V. C. MYERS (*Physiol. Rev.*, 4 (1924), No. 2, pp. 274-328).—Included in this account is a bibliography of 11 pages.

Anaerobic infections in animals, S. H. GAIGER (*Vet. Rec.*, 4 (1924), Nos. 47, pp. 986-989; 48, pp. 1003-1014).—This account, by the director of the Animal

Diseases Research Association Laboratory, deals with the *Bacillus chauvoei*, *Vibrio septique* (Pasteur, 1877), *B. welchii* (Migula, 1900), *B. oedematiens* (Weinberg and Séguin, 1915), *B. histolyticus* (Weinberg and Séguin, 1915), *B. sporogenes* (Metchnikoff, 1908), and *B. botulinus* (Van Ermengem, 1896). The paper includes a list of 54 references to the literature.

Anaplasmosis in Chile [trans. title], J. DESCAZEUX (*Bul. Soc. Path. Exot.*, 17 (1924), No. 8, pp. 639-642).—The author reports that anaplasmosis is the cause of a large number of deaths among cattle in Chile in the vicinity of Traiguén, the symptoms observed being those of acute anemia with a predominance of nervous manifestations. The parasite found in the red corpuscles resembles *Anaplasma argentinum*. The incubation period was found through inoculation to be from 25 to 30 days. The animals recover after 8 to 10 days, but are never really fit for work. Sheep are very susceptible to anaplasmosis in Chile.

Rats as possible carriers of foot-and-mouth disease, J. M. BEATTIE and D. PEDEN (*Jour. Path. and Bact.*, 27 (1924), No. 4, pp. 415-424, figs. 4).—This is a detailed report of the experimental transmission of this disease to rats and of the examination of wild rats, a brief account of which has been previously noted (*E. S. R.*, 51, p. 83).

Experiments on active immunization against foot-and-mouth disease [trans. title], O. WALDMANN and K. TRAUTWEIN (*Arch. Wiss. u. Prakt. Tierheilk.*, 50 (1923), No. 3, pp. 229-236).—Data are reported on the immunization of cattle against foot-and-mouth disease by the subcutaneous injection of virulent guinea pig blood.

Of 30 cattle tested for susceptibility to foot-and-mouth disease, 13 were selected as highly susceptible, and were injected subcutaneously with from 1 to 27 cc., or intravenously with 15 cc., of virulent guinea pig blood and tested for immunity in from 15 to 21 days by intracutaneous or intravenous injections of virulent swine lymph. Of the 30 animals, only two, the ones injected with 1 cc. of virulent blood, showed any signs of reaction. In these two there was a slight rise in temperature accompanied by local reaction. This was attributed to the small dose employed. Similar experiments were conducted on calves and swine but with less favorable results.

Foot-and-mouth disease (*Vet. Rec.*, 5 (1925), No. 1, pp. 3, 4).—This is a comparison of the slaughter and isolation methods of combating foot-and-mouth disease, prepared by the Ministry of Agriculture, England.

Tick biting experiments in bovine and cervine piroplasmosis, H. C. CLARK and J. ZETEK (*Amer. Jour. Trop. Med.*, 5 (1925), No. 1, pp. 17-26).—A survey of the disease among domestic and wild animals made in the lower part of the basin of the Chagres River in Panama, in 1917, led to the discovery of piroplasmosis in the native cattle of the basin and in the white-tailed deer (*Odocoileus chiriquensis* Allen). Of 10 deer killed, 4 were found to contain piroplasms with the characteristics of those occurring in cattle. Of 42 white-tailed deer killed by a hunting club, only one gave evidence of serious illness. This animal, extremely emaciated and most heavily infested with ticks, was found to be suffering from a verminous broncho-pneumonia and liver fluke disease and had an associated acute attack of piroplasmosis. The vast majority of the ticks removed from this deer proved to be *Margaropus annulatus australis*, but there were also a large number of *Amblyomma cajennense* present. Nearly all the deer were in prime physical condition, yet the majority revealed piroplasms in some of the capillary blood cells of brain films, and in a few cases long searches revealed them in blood films of the peripheral circulation.

In one instance in tick transmission experiments the progeny of ticks removed from the sick deer were capable of producing a mild attack of piroplasmosis in a half-breed, nonimmune calf. The ticks in question were *M. annulatus australis*. In another instance a mild attack of piroplasmosis was produced in a brocket deer (*Mazama sartinii reperticia* Goldm.) through attachment to the animal in a massive manner by the progeny of *M. annulatus australis* taken from prime beef cattle at the time these animals were slaughtered in Panama City.

It is thought probable that cervine and bovine *Piroplasma* are identical. If not, then *M. annulatus australis* is capable of being a carrier agent for two types of *Piroplasma*. The practical value of these experiments is the indication that the deer makes an important reservoir for cattle piroplasmosis.

Bayer 205 (Naganol) and the treatment of trypanosomiasis in animals [trans. title], R. VAN SACEGHEM (*Compt. Rend. Soc. Biol. [Paris]*, 91 (1924), No. 37, pp. 1452-1454).—The author finds this therapeutic agent to be more active in its effect on *Trypanosoma congolense* than it is on *T. vivax*. For use against infections of *T. vivax* it is not as effective as tartar emetic, and against *T. congolense* it does not appear to be more effective than emetic-atoxyl.

Establishing a tuberculosis-free dairy herd, S. E. B. (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 2, pp. 138-149).—This is a discussion of the subject as applied to conditions in Great Britain.

Infectious abortion investigations, H. F. LIENHARDT, C. H. KITSELMAN, and C. E. SAWYER (*Kansas Sta. Tech. Bul.* 14 (1925), pp. 4-23, fig. 1).—The investigations reported covered a period of five years ended June 30, 1924.

Bacterial examination of vaginal discharges, afterbirths, aborted fetuses, and milk from 119 cows which had aborted gave the following results: *Bacterium abortus* 21, *B. abortus* plus other organisms 20, pathogenic organisms other than *B. abortus* 59, and no organisms 19. These results confirm those of an earlier progress report (E. S. R., 49, p. 477) indicating that *B. abortus* is not the sole cause of abortion disease. In the isolation of the organism from infected material, the most satisfactory medium proved to be 2 per cent glucose, 2 per cent glycerin agar, pH 7.2, with 10 per cent horse serum in sealed jars with 10 per cent CO₂ gas.

An attempt was made to produce experimental lesions in two heifers by intraperitoneal injections of large doses of the organism grown in pure culture. After 30 days the animals were killed and autopsied. No changes of a pathological nature could be detected in either animal, but from one the organism was isolated in pure culture. In both of the animals there was a decided rise in the number of agglutinins in the blood serum.

An examination of 20 strains of *B. abortus* showed no differences in either morphology or sugar reactions in all but three of the strains. These were found to be members of a colon subgroup. In cross agglutination tests, the identity of the 17 strains and the nonidentity of the others were also established.

Attempts at immunity production were made in a small experimental herd of 12 cows. This was divided into four groups, three of which were vaccinated, bred, and then fed *B. abortus*-contaminated feed and water. The groups were treated as follows: (1) Three animals were injected subcutaneously at weekly intervals with 3 doses of physiological saline suspension of *B. abortus* heated for one-half hour at 60° C., (2) 3 were injected in the same manner with a suspension of *B. abortus* killed by 1 per cent formalin, and (3) 4 were injected subcutaneously with 5 doses of living organisms suspended in physiological salt solution. In the first group all of

the animals gave positive agglutination tests immediately after the third injection, and the tests remained positive for about 7 weeks. Two of the 3 animals aborted. In the second group the response to the agglutination test was similar to the first group and 1 cow aborted. In the third group the agglutination tests were more strongly positive and continued positive for a longer time than in the other two groups. There was one abortion in this group. Both of the unvaccinated controls calved normally.

The number of animals used in the immunization tests is considered too small to warrant drawing final conclusions, but it is considered significant that the abortions all occurred among the vaccinated animals.

Vaccination against bovine infectious abortion [trans. title], W. ZWICK (*Berlin. Tierärztl. Wchnschr.*, 40 (1924), No. 48, pp. 673-676).—The literature on attempts at immunization against *Bacterium abortus* infection by the use of killed and living cultures of the virulent organism is reviewed, and the results are reported of immunization experiments conducted on five herds.

All of the pregnant animals were tested serologically and those giving positive reactions were given two subcutaneous injections at intervals of from 10 to 14 days of a suspension of live organisms in physiological salt solution. The negatively reacting pregnant animals were similarly treated with killed cultures, and the nonpregnant animals received the same treatment as the positively reacting pregnant ones.

Of 23 positively reacting pregnant animals, 3 aborted, and of 30 negatively reacting animals treated with killed cultures, 6 aborted. Three negatively reacting pregnant animals were vaccinated in the second month of pregnancy with living cultures and all calved normally. A fourth which was vaccinated 2 and 14 days after conception also calved normally. It is concluded that the use of living cultures early in pregnancy is a safe procedure.

Actinobacillosis in Australian cattle, S. DODD (*Agr. Gaz. N. S. Wales*, 35 (1924), No. 11, pp. 807-812).—A brief report of investigations of this disease, which has been under the author's observation in abattoirs near Sydney for some years.

Blackleg and gas gangrene in cattle [trans. title], E. LECLAINCHE and H. VALLÉE (*Compt. Rend. Acad. Sci. [Paris]*, 178 (1924), No. 25, pp. 2024-2027; also in *Rev. Gén. Méd. Vét.*, 33 (1924), No. 391, pp. 357-361).—A brief résumé is given of studies conducted by the authors, with the collaboration of Glover and Pincemin, on blackleg and allied diseases of cattle.

In the experience of the authors *Bacterium chauvoei* isolated from gas gangrene is characterized by being nonpathogenic for horses, virulent for calves and guinea pigs, incapable of producing in the peritoneal cavity of guinea pigs long forms of unequal dimensions, and incapable of agglutination in concentrations of less than 1:50 with a septic antivibrion serum which agglutinates in 1:1,000 with cultures of *Bacillus septicus*. An authentic culture of *B. septicus* is avirulent for cattle by subcutaneous inoculation and highly pathogenic for the horse and guinea pig. In the guinea pig the cultures are long and of unequal length. This organism is not agglutinable in dilutions above 1:50 with serum which agglutinates *B. chauvoei* in dilutions above 1:20,000. Immunity reactions with these two species are quite specific.

In addition to these two organisms there may be isolated other types morphologically and biologically identical and capable of provoking symptoms of gas gangrene quite analogous to but not identical with blackleg. Finally, there are types resembling in some degrees *B. chauvoei* and in others *B. septicus*. The presence of so many organisms is thought to justify the use of attenuated polyvalent vaccines in place of toxins and aggressins.

Preparasitic stages in the life history of the cattle hookworm (*Busotomum phlebotomum*), B. SCHWARTZ (*Jour. Agr. Research* [U. S.], 29 (1924), No. 9, pp. 451-458, figs. 4).—This is a report of studies of a hookworm which is believed by Dawson (E. S. R., 18, p. 877) to be the cause of that condition of cattle commonly known as "salt sick." It is pointed out that, with the exception of a study of Conradi and Barnett (E. S. R., 20, p. 382), none has been made of the life history of this parasite.

The author finds that, under laboratory conditions, at a temperature of from 70 to 80° F., the eggs of *B. phlebotomum* hatch in about 96 hours. "The first-stage larvae are found in lethargus 24 hours after hatching and 24 hours later the second lethargus is in progress. After a second lethargus, which lasts at least 24 hours, third-stage larvae emerge, the complete cycle of development up to this stage requiring a minimum of 7 days. In liquid cultures both cuticles are usually retained by the larvae, whereas in solid cultures the first cuticle is cast off. Observations on the loss of the first skin by infective larvae from liquid cultures indicate that contact with some solid object is necessary for exsheathing, and that in a liquid medium this process does not ordinarily take place.

"Infective larvae are only moderately active at room temperature, but may be readily stimulated to activity by mechanical factors. These larvae appear more resistant to an unfavorable environment than do preinfective larvae. Infective larvae are positively thermotropic and orient themselves in such a way that the cephalic extremity becomes directed to the source of heat, toward which the larvae swim rapidly. . . . The infective larvae succumb to desiccation, but can maintain their vitality under conditions which afford a slight amount of moisture. The infective larvae are positively phototropic, collecting in the lightest portion of the culture medium. They also crawl up the walls of culture bottles, but whether the latter is to be interpreted as a negative geotropism or is due to the positive phototropism of the larvae is not certain.

"Under experimental conditions the larvae show no tendency to penetrate the skin. Attempts made by various writers to correlate the behavior of various strongyle larvae with their skin-penetrating habits appear to be untenable from the data presented in this paper and from data obtained by others."

•A list is given of 15 references to the literature cited.

Experimental investigations on immunization against swine erysipelas, with special regard to susceptibility [trans. title], W. SCHMIDT (*Arch. Wiss. u. Prakt. Tierheilk.*, 50 (1924), No. 4, pp. 341-350).—The chief point brought out in this experimental study of the immunization of mice against swine erysipelas by the simultaneous method is the necessity of a proper balance between serum and virus so that there shall be sufficient virus to stimulate the production of antibodies but not to exceed the protective power of the serum. The more sensitive the subject the longer is the time required for antibody formation. The immunity can be prolonged in most cases by a second injection of a less virulent culture after the establishment of immunity by means of the simultaneous treatment.

In the practical application of these results to the immunization of swine, the second injection is recommended unconditionally for animals which are sensitive to this disease, while for more resistant races the single simultaneous injection is considered sufficient.

A contribution to the knowledge of hyphomycosis destruens, J. WITKAMP (*Bijdrage tot de Kennis van de Hyphomycosis Destruens. Proefschr., Veeartsenijk. Hoogesch. Utrecht*, 1924, pp. 139, pls. 16).—This is a general

review of the knowledge of hyphomycosis of horses, also known as hyphomycosis destruens equi, leeches, and bursattee, with references to the literature and a report of investigations conducted by the author. A bibliography of five pages is included.

Leptospiral jaundice in dogs (yellows), C. C. OKELL, T. DALLING, and L. P. PUGH (*Vet. Jour.*, 81 (1925), No. 595, pp. 3-35, figs. 3).—Clinical and pathological observations and experimental work have led to the conclusion that the commonly occurring enzootic jaundice of dogs is due to infection with *Leptospira icterohaemorrhagiae*, which, in Great Britain, is normally carried by a considerable percentage of rats.

[A vitamin deficiency disease of poultry in California], J. DRYDEN (*Country Gent.*, 89 (1924), No. 48, p. 32).—This article refers to a disease which closely resembles roup, investigated by J. R. Beach (*E. S. R.*, 50, p. 871), and found to be a nutritional disease due to the lack of vitamin A.

The bacteriological study of fowl typhoid and allied infections with special reference to three epidemics, J. W. EDINGTON (*Jour. Path. and Bact.*, 27 (1924), No. 4, pp. 427-437).—In connection with a study of the organisms isolated from three epidemics of white diarrhea in chickens, pure cultures of the organisms responsible for fowl typhoid and allied diseases were examined as to morphology, cultural characteristics, fermentation reactions, and agglutination and complement fixation tests, particular attention being paid in the serological tests to a possible differentiation between *Bacillus gallinarum* and *B. pullorum*. The results obtained are summarized and compared with those reported by Hadley et al. (*E. S. R.*, 40, p. 685) and other investigators.

The classification adopted as the result of this study differs slightly from that of Hadley, and is as follows: (a) Fowl cholera, due to *B. avisepticus*; (b) fowl typhoid group, due to *B. gallinarum* and *B. pullorum*; (c) infections due to *B. rettgeri*; and (d) infections due to *B. pfaffi*. No difference could be detected in the agglutination and complement fixation tests between *B. pullorum* and *B. gallinarum*.

A study of the organisms isolated in the three epidemics showed them to be identical and to belong to the pullorum group.

European fowl pest found in poultry in the United States, J. R. MOHLER (*Vet. Med.*, 20 (1925), No. 2, pp. 57, 58).—This is a brief summary of information on this disease, which has been found to occur in New York City, Jersey City, and Philadelphia.

The outbreak of the European fowl pest, B. F. KAUPP (*Vet. Med.*, 20 (1925), No. 2, pp. 63, 64).—A brief account of this disease, which was discovered, about the middle of December, 1924, in the vicinity of New York City.

The new poultry disease, H. J. STAFSETH (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 83-85).—This is a discussion of the symptoms, lesions, diagnosis, and prevention of a poultry disease similar to or identical with European fowl plague, which was found in the poultry markets in Detroit in January, 1925.

[The use of calcium cyanide in the] killing of condemned chickens, C. W. WINCHELL (*Rural New Yorker*, 84 (1925), No. 4830, p. 76).—In the course of control work with European fowl pest, the destruction of some 25,000 or 30,000 birds was successfully accomplished by the Jersey City Board of Health through the use of calcium cyanide. The method is said to be very simple, 1 lb. of calcium cyanide being used for about 2,000 fowls. The fowls destroyed were in the regulation live poultry cars, in shipping crates, in a box car, or in a large covered automobile truck. Where the birds were in exposed places calcium cyanide dust was blown on them from the windward side, and where

they were in a box car or inclosed truck 1 lb. of calcium cyanide flake was sprinkled on the floor for each 2,000 birds. Fowls died within one or two minutes, almost without struggling.

RURAL ENGINEERING

Ground water in Santa Clara Valley, California, W. O. CLARK (*U. S. Geol. Survey, Water-Supply Paper 519 (1924), pp. VII+209, pls. 19, fig. 20*).—This report, prepared in cooperation with the Department of Engineering of the State of California, deals with the ground water of an area of 380,000 acres extending southeastward from San Francisco. It has been found that the ground water of Santa Clara Valley is on the whole satisfactory for both domestic use and irrigation. A few wells have water that is not considered good for domestic use or is said to be injurious to plants. The largest group of such wells is in a small area with meager water supply. All the wells of this locality are of small yield, and many of them can be pumped dry with an ordinary windmill.

Surface water supply of North Atlantic slope drainage basins, 1922 (*U. S. Geol. Survey, Water-Supply Paper 541 (1925), pp. VI+258, pls. 2*).—This report, prepared in cooperation with the States of Maine, New Hampshire, Vermont, Massachusetts, New York, and New Jersey, presents the results of measurements of flow made on streams of the North Atlantic slope drainage basins during the year ended September 30, 1922.

[Irrigation experiments at the Utah Station], D. W. PITTMAN and G. STEWART (*Utah Sta. Bul. 192 (1925), p. 24*).—It is stated that in the course of irrigation experiments it has been definitely established that the heavier the irrigation treatment the more rapid is the exhaustion of the soil.

Pumping for drainage in the San Joaquin Valley, California, W. W. WEIR (*California Sta. Bul. 382 (1925), pp. 3-38, figs. 18*).—This bulletin reports an attempt to gather together and correlate some of the important data on pumping for the drainage of irrigated lands in the San Joaquin Valley, Calif.

It is stated that the cost of drainage by this method compares favorably with that of any other method yet tried, although the cost of operation is more. It has been found that more effective drainage may be accomplished by pumping than by tile or open drains because of the flexibility of the pumping system and the greater depth to which it is economically feasible to lower the water table. The pumped water is readily available for irrigation and compensates in part for the cost of drainage by this method.

Public Roads, [February, 1925] (*U. S. Dept. Agr., Public Roads, 5 (1925), No. 12, pp. 22, figs. 19*).—This number of this periodical contains the status of Federal-aid highway construction as of January 31, 1925, and a list of the 48 States and Hawaii showing their apportionment of Federal-aid funds for the fiscal year 1926, together with the following articles:

Impressions of English Highway Practice, by A. B. Fletcher; Percentage of Water Freezable in Soils, by A. W. Wintermyer (see p. 719); A Study of Motor Vehicle Accidents in Montana, Oregon, and Washington, by A. C. Rose; Crushed Stone Tests and Their Relation to the Service of the Finished Pavement, by A. T. Goldbeck; and Reinforced Concrete Pavement Survey, by C. A. Hogentogler.

Rural highway mileage, income, and expenditures, 1921 and 1922, A. P. ANDERSON (*U. S. Dept. Agr. Bul. 1279 (1925), pp. 88*).—A large amount of data on the subject is tabulated. These data show that on January 1, 1922, the rural public roads of the 48 States had a total length of 2,941,294 miles

and involved a disbursement of \$1,036,587,772 during the year 1921. Of the total road mileage, 387,760 miles had been improved with some form of surfacing when the year 1922 began.

Of the individual States, Indiana at the beginning of 1922 had the largest mileage of surfaced roads, a total of 39,857 miles, of which 30,801 miles were gravel. California led the States in the mileage of concrete roads, with 2,613 miles, followed by Illinois with 1,534 miles. Ohio was first in the mileage of brick roads and Florida second, while Oregon was first in mileage in bituminous concrete, followed closely by New Jersey. During the year 1921 a total of 41,171.7 miles of road were improved with some form of surfacing, and 34,456.3 miles were thus improved during 1922.

Highway transportation costs, T. R. AGG and H. S. CARTER (*Iowa Engin. Expt. Sta. Bul. 69 (1924), pp. 32, figs. 6*).—This publication presents a discussion of highway transportation costs, which is an outgrowth of a rather prolonged study of the various factors affecting vehicle operating cost, such as rolling resistance and the relation between road types, fuel consumption, and general operating costs of vehicles, and which has been carried out for the most part by the Engineering Experiment Station of Iowa State College in co-operation with the U. S. D. A. Bureau of Public Roads. The discussion of the economic principles involved in providing highway transportation at the minimum cost is intended to show the nature of the problems involved, and concerns itself with both vehicle and highway costs.

United States Government specification for lubricants and liquid fuels and methods for testing (*U. S. Dept. Int., Bur. Mines Tech. Paper 323A (1924), pp. VII+89, figs. 21*).—The text of these specifications is presented in detail.

Tetralin, F. NATHAN (*Fuel, 3 (1924), No. 10, pp. 346-349*).—Data on the history, manufacture, and use of tetralin for fuel in internal-combustion engines are presented. Tetralin is a colorless, stable hydrocarbon, and is considered to be a liquid fuel of considerable value. Owing to its high boiling point it can not be used undiluted as a motor fuel, but it has been found very suitable for that purpose when mixed with gasoline, benzol, or alcohol.

Comprehensive tests conducted at the Berlin Technical High School have shown the most satisfactory results with a mixture of equal parts of tetralin and ordinary gasoline, these being approximately equal to those obtained with benzol. Tetralitbenzol is a mixture of benzol, alcohol, and tetralin, and is called "Reichskraftstoff" in Germany. This fuel has a calorific value of 8,350 calories. It produces no carbon deposit and has, on the other hand, been found capable of thoroughly dissolving such deposits, which are removed in a few days by the escaping gas.

Tests conducted in England at the Government Fuel Research Station showed that mixtures of tetralin and gasoline containing less than 50 per cent of tetralin are apparently quite suitable for use in ordinary 4-cylinder automotive engines without any special adjustments. In every case it was found that mixtures of tetralin and gasoline are not so good as gasoline alone, either in flexibility of running, maximum power obtained, or thermal efficiency, but the inferiority is not sufficiently marked to preclude the use of tetralin, especially if it is slightly cheaper than gasoline. There were indications that a higher compression ratio may be used with mixtures of tetralin and gasoline than with gasoline alone. When the mixture of gasoline and tetralin contained more than 50 per cent of tetralin, the engine could be operated, but was much less flexible and the power and efficiency were decreased considerably. It was found in general that as the proportion of tetralin in the fuel increases the faults associated with incomplete combustion also increase.

Wind power for farm electric plants, F. J. PANCRATZ (*Mech. Engin. [New York]*, 46 (1924), No. 11, pp. 675-682, figs. 10).—A rather technical discussion is presented on test data on a 15-ft. wheel, losses due to air drag, the best size of wheel for farm electric light plants, and a combination plant for generating electric power and pumping.

The data as a whole indicate that the characteristics of a windmill are not favorable for large units. A 20-ft wheel is about the largest size that can be used and give satisfactory results for generating electric power. The smaller sizes of wheel are considered to offer a cheap and reliable means of supplying the average farmer or isolated places with the necessary electric power and water, and the first cost, cost of operating, and depreciation are said to compare very favorably with those of gasoline lighting plants.

Ploughing without turning the furrow, in Austria, H. KALLBRUNNER (*Internatl. Rev. Sci. and Pract. Agr. [Rome]*, n. ser., 1 (1923), No. 3, pp. 587-594, pl. 1).—The method in vogue in Austria of plowing without turning the furrow is described and illustrated, and some of the advantages claimed for this process are enumerated. The method is based on the principle that it is necessary to avoid the making of clods, which are extremely difficult to break up. The best implement for this operation is said to be an ordinary plow from which the moldboard for turning the furrow has been removed. As a rule, an attempt is made to break up the soil to as great a depth as possible. In the spring before seeding cultivators alone are used, and no attempt is made to break up the subsoil completely.

The use of wide, light harrows is also recommended. Practical experiments have shown that by breaking up the soil twice in this manner instead of once has resulted in a saving of labor of from 30 to 40 per cent.

Motorized soil cultivation, B. SIEVERS (*Motorische Bodenbearbeitung. Neudamm, Germany: J. Neumann, 1924, pp. 99+[3]*).—This treatise deals with the practical phases of the subject, with particular reference to the requirements of German agriculture. It contains a discussion of the scientific bases of soil cultivation, and describes different cultivation methods. Reasons for the selection of different motorized plowing systems are enumerated, and the practical features of motorized cultivation are outlined in some detail.

A study of threshing losses from different types of harvester-threshers and headers and threshers on the Nephi-Levan ridge, A. F. BRACKEN (*Utah Sta. Bul. 192 (1925), p. 23*).—Tests of threshing losses from about 12 harvester-threshers showed that the losses varied from about 4 lbs. to nearly 20 lbs. per acre for the harvester-threshers. This is considered to be a surprisingly low loss. In most cases the loss from the headers equaled that from the combines, and in addition the stationary gave a loss of about 1.75 per cent.

Drying by means of air and steam, E. HAUSBRAND, trans. by A. C. WRIGHT (*London: Scott, Greenwood & Son, 1924, 3. rev. Eng. ed., pp. VIII+77, pls. 2, figs. 7*).—This book, translated from the German, presents mathematical formulas and tabular data for calculating the dimension of apparatus, for drying wet material by means of air, and for determining the consumption of air and heat in such drying apparatus. Chapters are included on calculation of the maximum weight of saturated aqueous vapor which can be contained in 1 kg. of air at different pressures and temperatures; calculation of the necessary weight and volume of air and of the least expenditure of heat for drying apparatus with heated air at atmospheric pressure; drying apparatus in which in the drying chamber a pressure higher or lower than that of the atmosphere is artificially maintained; drying by means of superheated steam without air; and heating surface, velocity of the air current, dimensions of the

drying room, surface of the drying material, and losses of heat. An appendix of metric conversion diagrams is also included.

Studies on the biology of sewage disposal, M. HOTCHKISS (*Jour. Bact.*, 9 (1924), No. 5, pp. 437-461, figs. 7).—Two contributions from the New Jersey Experiment Stations and the New Jersey State Department of Health are presented.

A survey of the bacteriological flora of a sewage treatment plant.—By the use of the dilution method employing different media, the bacterial population in a sewage disposal plant was divided into arbitrary groups according to the physiological activities produced. These were organisms (1) reducing nitrate to nitrogen gas, (2) splitting protein with the production of hydrogen sulfide, (3) liquefying coagulated egg albumin, (4) reducing inorganic sulfates to hydrogen sulfide, (5) oxidizing ammonium salts to nitrites, (6) oxidizing nitrites to nitrates, and (7) oxidizing thiosulfite to sulfate. No attempt was made to isolate and observe individual bacterial types.

The largest number of bacteria per cubic centimeter was found in the digestive chamber of the Imhoff tank. This was true whether organisms of a reducing or of an oxidizing type were considered. The effluent from the sprinkling filter, except at the time of slough, contained the fewest bacteria per cubic centimeter.

Of the groups considered, the organisms most important numerically throughout the plant were the nitrate reducers, the hydrogen sulfide producers, and the albumin digesters. Nitrifying and sulfur oxidizing bacteria occurred throughout the plant and were consistently found even in the digestion chamber of the Imhoff tank. The material from the digestion chamber, however, contained no nitrites or nitrates. The number of nitrifying organisms increased in the filter bed, although they never became numerically predominant, and higher percentages of nitrifiers were found in liquid which had trickled through the lower levels of the bed than in that collected near the surface.

There was a drop in the numbers of hydrogen sulfide producing organisms as the sewage passed through the plant. This was the most striking change in the bacterial flora which could be demonstrated. It is stated that in general in a sewage plant handling stale sewage in a quantity at about its capacity, the proteolytic and reducing organisms overbalance the oxidizing organisms. However, the results are taken to indicate that by careful operation of a plant a satisfactory effluent can nevertheless be obtained.

A sprinkling filter bed and its bacteriological population.—These studies showed that the film about the stones of a sprinkling filter bed contains bacteria able to accomplish the same physiological activities as those which occur in an Imhoff tank. The stones are seeded by the effluent from the Imhoff tank which is sprayed over their surface. Conditions in the bed affect the types of bacteria with the result that the proteolytic bacteria decrease as the stones of the lower level of the bed are reached, while the oxidizing bacteria increase. This increase in oxidizing bacteria confirms the chemical analyses which show a higher nitrate production in the lowest level of the filter bed. Since many bacteria are able to effect denitrification, these types of bacteria may also be demonstrated readily in the sprinkling filter film.

Investigation of farm sewage disposal systems, R. H. DRIFTMIER (*Agr. Engin.*, 5 (1924), No. 10, pp. 232, 233).—In a contribution from the Kansas State Agricultural College an outline is presented of the research features involved in a fundamental study of the disposal of farm sewage. It is considered advisable when entering in a broad, general way into a study of farm sewage disposal to begin with an analysis and classification of conditions on the basis

that purification of sewage is primarily a biological phenomenon, regardless of the type of system employed. It is stated that since the biological conditions for an absolutely purifying sewage disposal system are not known, the problem logically resolves itself into a joint one for the agricultural engineer and the biologist. This would result in studying biological decomposition and purification entirely separately from the septic tank, in order to establish the exact conditions which must later be met by the engineer in the design of the tank.

An extensive bibliography on the subject is included.

RURAL ECONOMICS AND SOCIOLOGY

Report of investigational work in agricultural economics, A. G. WALLER (*New Jersey Stas. Rpt. 1923, pp. 166-191, pls. 11*).—Investigational work in the cost of producing farm products and the best farm practices carried on by New Jersey Stations for the year ended June 30, 1923, is reported upon.

Poultry investigations.—The cost of producing 8,893 capons on 66 farms in Burlington County, N. J., is summarized. The gross sales per farm amounted to \$544.62 and the gross cost to \$240.68.

Potato investigations.—A preliminary statement of the production, costs, and profits of potatoes in New Jersey, and of the competition from other principal potato-producing areas is given here, following an investigation made in September, 1922. Census returns and unpublished data furnished by the U. S. Department of Agriculture are tabulated and briefly discussed. Correlations between the production of potatoes from 1899 to 1921, inclusive, and that of peaches, apples, sweet potatoes, and rice, and between the production and farm prices of potatoes with farm prices lagging one year, as well as the deviation from the 5-year average, 1909-1914, in production and farm prices of potatoes December 1, are presented graphically.

Rye investigations.—The margin of profit for buyers of rye and the course of prices paid the farmers in New Jersey during each year 1909 to 1922 were determined in considering the question of whether growers should do their own threshing and baling rather than selling the sheaf according to the present practice. The second alternative was held to be probably more advisable.

Fruit investigation.—The development of orchards by sections of the State, the production per capita, and the total crop, prices, and prospects for production of apples and peaches are shown graphically on the basis of census statistics for periods of years.

The relative economy of ox labour in South African farming, E. PARISH (*So. African Jour. Sci., 20 (1923), No. 2, pp. 316-322, fig. 1*).—From information obtained incidentally in the investigation of the cost of production of corn, it is concluded that horse and mule labor in South Africa is generally from 40 to 50 per cent more costly than ox labor. It is held that the price of land very largely determines the cost of ox labor. A progressive increase in the value of the land is observable in South Africa, and the cost of ox labor is also rising, proportionately less rapidly, however, than is the value of the land. It may be expected that when land has increased to more than one and a half times its present value the ox will begin to lose his relative superiority to the horse and will tend to be supplanted. It is assumed that this displacement will not be completed in the present generation.

The formation of small holdings in Sweden, W. I. PETTERSSON (*Internatl. Rev. Agr. Econ. [Rome], n. ser., 2 (1924), No. 2, pp. 215-230*).—This article

briefly describes the history of the subdivision of land in Sweden and the measures adopted to facilitate it. The problem is said to be growing constantly more complicated because of a diversity of opinion among the different political parties. The number of persons who apply under the system for loans for the purchase of property is said to be increasing yearly.

A study of the onion industry in Pleasant Valley, Iowa, A. T. ERWIN and W. L. HARTER (*Iowa Sta. Bul.* 225 (1925), pp. 257-286, figs. 16).—Herein are presented the results of an economic study of onion production on a small area in Scott County, where, under intensive methods, there are annually produced on 500 acres an approximate yield of 200,000 bu. of onions. Tenancy is comparatively rare, 90 per cent of the growers being owners, and the average size of the holdings being 10 acres. Approximately 85 per cent of the acreage is grown from seed, almost exclusively locally grown. Records showed that 220 hours of hand and 62 hours of horse labor are required per acre, and of the manual labor 50 per cent is used in August in harvesting and marketing the crop. Onions are marketed immediately after harvest, the bulk of the crop being shipped to the Cotton Belt States.

Cost of production data, consisting largely of estimates, were obtained from men who had been growing onions at least 5 years. It was determined that with a yield of 400 bu. per acre the cost was approximately 45 cts. a bushel. On the farms studied the costs varied from as low as \$91 per acre on one farm to as high as \$235 on another on which 12 acres were grown on land not previously freed from weeds. The labor incomes realized ranged from \$62 in the case of one man cultivating 1 acre to \$2,436 earned by another on 22 acres.

Cost of producing strawberries, A. L. WILSON (*Utah Sta. Bul.* 192 (1925), p. 40).—The costs at which two crops of strawberries of the Marshall variety, which was planted in 1922, were harvested from a tract of 0.38 acre on the Davis County Experimental Farm are briefly tabulated.

How to keep a cash account on a farm, V. B. HART (*Ithaca: N. Y. State Col. Agr., Cornell Univ.* [1924], pp. 33).—Simple directions and blank forms for keeping a record of receipts and expenses are provided.

Agricultural wages in Switzerland [trans. title], E. LAUR and H. NATER (*Sec. Paysans Suisses Pubs., Nos.* 31 (1908), pp. IV+135; 40 (1911), pp. VII+113; 70 (1923), pp. 111).—The first of two inquiries reported here was instituted in 1906. It was concerned with the salaries paid in that year to domestics and rural day laborers, as well as wages paid in the various decades of the nineteenth century. It also inquired into the dearth of laborers, their standard of living, hiring agencies, and other matters. The second was carried on in 1921 and is very similar in plan, covering the wages paid all classes of workers by cantons and by kinds of work and comparing wages before and after the war.

Assessment and equalization of farm and city real estate in Kansas, E. ENGLUND (*Kansas Sta. Bul.* 232 (1924), pp. 3-70, figs. 5).—A statement in the abstract of this publication (*E. S. R.*, 52, p. 294) should be corrected to state that a greater equality is found among townships than among other assessing units or among individual properties.

Facts and figures regarding cooperative livestock shipping in Ohio, B. A. WALLACE (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 11-12, pp. 204-209).—A short summary analysis of answers from shipping associations in the State to a questionnaire (*E. S. R.*, 51, p. 893) is given. A wide divergence in the weights and prices at which livestock is marketed in different counties is noted. The total expense of marketing each 200 lbs. of hogs sold in 1922 ranged from

\$1.01 to \$1.63, averaging \$1.29. The net return to the farmer varied from \$18.07 to \$19.97, averaging \$18.61.

Crops and Markets, [February, 1925] (*U. S. Dept. Agr., Crops and Markets*, 3 (1925), Nos. 6, pp. 81-96; 7, pp. 97-112, fig. 1; 8, pp. 113-128; 9, pp. 129-144).—Statistics and summary reports are given from weekly current market reports, relating to important classes of agricultural products and specific commodities, and brief special articles are given reviewing their position in the market. Foreign crops and markets notes are presented.

Monthly Supplement to Crops and Markets, [February, 1925] (*U. S. Dept. Agr., Crops and Markets*, 2 (1925), Sup. 2, pp. 33-72, figs. 3).—This supplement is devoted largely to livestock reports, including tabulations showing the estimated number and value of principal classes, January 1, 1925, with comparisons, and reports covering two milch cow surveys made June 1 and December 1, 1924. Statistics of the birth rate of horses and mules, the estimated wool production of the United States, 1919-1924, and corn and hog ratios, 1910-1924, together with a western livestock and range report, are given. Truck crop production and the imports of forage plant seeds are tabulated. The usual estimated farm prices of important products and statistics of cold storage holdings, the livestock and meat situation, average prevailing farm wage rates, and fruit and vegetable shipments and prices are presented, together with a review of the general price situation.

The price situation in agriculture in the years 1920-21 to 1922-23, inclusive [trans. title], FENSCH (*Deut. Landw. Rat Veröffentl.* 1 (1923), pp. 22).—A compilation of price data is presented here in tabulations of index numbers of wholesale prices, cost of living, and the prices of farm products, including grain, sugar beets, hay and straw, meat, and milk, as well as of supplies such as fertilizers, seeds, tools, machinery, fuel, and feeds, for the three years. Comparisons are made of monthly averages and of the purchasing price of the dollar. Phenomenal and irregular increases, especially in the last of the three years, in the prices of supplies are exhibited. It is pointed out that under such price conditions the orderly organization and conduct of the farm business has been impossible in Germany.

The agrarian phase of the Mexican Revolution of 1910-1920, H. PHIPPS (*Polit. Sci. Quart.*, 39 (1924), No. 1, pp. 1-18).—This article describes Mexican history since the early part of the nineteenth century as consisting largely of a struggle between the proletariat and the privileged classes. Three principal revolutions are said to have taken place—the first banished the Spaniards, the second gave increased importance to the landed aristocracy and brought about the gradual disintegration of the Indian communal system of landholding, while the third was characterized by a more definite demand on the part of the Indians for agrarian reform, mainly in the way of the restoration of village lands.

A short history of English agriculture and rural life, C. J. HALL (*London: A. & C. Black, Ltd.*, 1924, pp. VIII+152, pls. 8, figs. 20).—This is a popular account beginning with farming and rural life in England before the twelfth century, and describing the manorial system, the black death and its effects, the introduction of sheep raising, rural life in the Tudor period, agricultural reformers and the revolution in the eighteenth and early nineteenth centuries, and the prosperity and the difficulties of later years, especially those attendant upon the World War.

Every-day life on an old Highland farm, 1769-1782, I. F. GRANT (*London and New York: Longmans, Green & Co.*, 1924, pp. XI+277, pls. 6).—The entries made in an old farm account book (*E. S. R.*, 51, p. 192) by one William

Mackintosh of Balnespick, a leaseholder of a farm in the upper valley of the River Spey in northern Scotland, are interpreted here to show the life and farming methods followed in a particular district in the Scottish Highlands at a period just between two important agricultural revolutions. Other writings are extensively cited in supplementing the farm notes. The chapters include an introduction, the psychological atmosphere, the general appearance and conditions of the countryside, farming at Dunachton in the eighteenth century, Balnespick's financial position, Balnespick and his contemporaries, the subtenants, and the relations between Balnespick and his tenants. Appendixes reproduce pages from the old book and charts showing the distribution of Balnespick's subtenants and their relations with him.

Where farming pays, and why, W. MEAKIN (*London: Agr. Gaz. and Mod. Farming*, 1923, pp. 64).—This is a description of the prosperity surrounding the agricultural industry in Denmark, which is largely attributed to cooperation.

An investigation with reference to agricultural associations in Switzerland [trans. title], E. LAUR and H. NATER (*Sec. Paysans Suisses Pubs.*, No. 68 (1923), pp. 93).—Information obtained during the winter of 1919–20 by means of a questionnaire is published here, setting forth the numbers of associations and their main purposes.

Agricultural co-operation in Bulgaria, P. N. ORECHKOFF (*Internatl. Rev. Agr. Econ.* [Rome], n. ser., 2 (1924), No. 2, pp. 240–260).—The organization of the first cooperative societies in Bulgaria is said to have taken place in 1898. Data with reference to membership and financial condition are presented, together with descriptive notes and the text of measures favoring cooperation.

Report on the working of the co-operative societies in the Punjab for the year ending 31st July, 1923, H. CALVERT (*Punjab Coop. Soc. Rpt.*, 1923, pp. [9]+60+CVII).—This annual report succeeds one previously noted (*E. S. R.*, 50, p. 795).

Some geographical factors affecting agriculture in South Africa, J. H. WELLINGTON (*So. African Geogr. Jour.*, 6 (1923), Dec., pp. 41–66, figs. 12).—This article is presented in sections dealing with general factors controlling agricultural production, structural and surface features of South Africa, climatic controls, agricultural value of the precipitation, soils of the Union, irrigation, and some important crops.

It is held that the physical conditions of the western part of the plateau region are such that this part of the Union of South Africa can not become an agricultural region, but that considerable areas may be cultivated if local irrigation can be profitably practiced. Certain portions of the eastern plateau region are adapted to the growing of corn, while sorghums appear to be the most dependable crop in other parts. The climatic and topographical advantages of the northern Transvaal have scarcely been exploited. The low veld regions of the Transvaal and Natal show a high potentiality for the production of cotton in the interior and sugar cane along the coastal strip. On the whole, the geographical conditions of South Africa are more favorable for stock farming than for agriculture.

Conference on the sociological implications of present-day agricultural movements (*Amer. Sociol. Soc. Pubs.*, 18 (1924), pp. 183–198).—Papers read at the conference under the leadership of C. C. Taylor, which was a part of the proceedings of the eighteenth annual meeting of the American Sociological Society at Washington, D. C., in December, 1923, are published as follows:

Some sociological implications of the farm bureau movement, E. C. Lindeman (pp. 183–189).—It is assumed that the sociological implications of any form of human organization are the possible, probable, and actual interactions

of dependent variables, and that from this point of view the farm bureau can prosecute its specialized economic program successfully only so long as it recognizes the individual personalities of its members. It is thought that an organization whose functions are preponderantly economic can not permanently refrain from engaging in social or political activities. The farm bureau movement can not survive without using its influence and power on behalf of specialized organizations, seeking to develop the school, the home, the church, recreation, and similar social interests.

The sociological implications of the co-operative marketing movement, B. F. Brown (pp. 190-193).—This analysis indicates that the cooperative marketing movement arose from a desire to improve rural conditions and from the recognition on the part of farmers of the fact that the strong position of big business is largely due to unification. Certain forces which are likely to militate against its successful operation are pointed out as lack of experience in cooperation and the opposition of such agencies as country buyers, warehousemen, and other so-called middlemen, who have a strong economic motive for the position they take. Cooperative marketing is said to have stirred the farmers of the South to constructive and broad thinking and to have widened their outlook considerably. The slow but steady increase in tenancy is said to be giving relatively greater importance to group activity.

Agrarian political movements with special reference to the Nonpartisan League, J. M. Gillette (pp. 194-198).—The influence of the Nonpartisan League is compared with that of earlier movements, such as the Farmers' Alliance and the Populist movement, and found to be of minor importance. It is said to have stimulated the growth of progressivism and the third party movement and to have left its impress upon the laws of North Dakota.

The cost of living among colored farm families of selected localities of Kentucky, Tennessee, and Texas, E. L. KIRKPATRICK and J. T. SANDERS (*U. S. Dept. Agr., Bur. Agr. Econ., 1925, pp. 13*).—Partial results of a study based upon schedules taken in the field for the year ended January 1, 1920, are presented in this preliminary mimeographed report. Averages are given for the size of the family and the household, ages of the members of the family, and the expenditures and goods used.

The majority of colored families in these regions were using from \$300 to \$899 worth of goods per year. Roughly about two-fifths of the family living was furnished by the farm without direct purchase, regardless of the average total value of the family living. Comparisons are made between colored owner, tenant, and cropper families. From the standpoint of the proportion of the total expenditures going for various purposes, tenant families appear to live about as well as owner families and somewhat better than do cropper families.

For many of the items reported upon the corresponding averages for white families of the localities studied are given by way of comparison.

The welfare of children in cotton-growing areas of Texas (*U. S. Dept. Labor, Children's Bur. Pub. 134 (1924), pp. V+83, pls. 6*).—This study was made in two cotton-growing counties of Texas, namely, Hill County, located in the north-central part of the State and chosen as typical of the black lands of the central prairie region, and Rusk County, near the Louisiana border, chosen as fairly representative of cotton-growing regions in east Texas. Information was secured through school attendance records and a house-to-house canvass in regard to all children between the ages of 2 and 16 years on September 30, 1920, living in families resident on farms in 13 school districts in Hill County and 12 in Rusk County for at least six months of the year previous to that date. A total of 1,121 families with 3,131 children were interviewed.

Four months or more had been devoted to picking cotton by 11 per cent of the white children of Hill County, while only 16 white and negro children in Rusk County had picked cotton four months or more. The average day's work for 153 children ranging in age from 3 to 15 years was slightly under 100 lbs. of cotton each. The majority of the children 14 and 15 years of age had averaged 150 lbs. or more a day, about three-fifths of those 12 and 13 years old had averaged over 100 lbs., and practically the same proportion of the 10- and 11-year-old boys and girls had picked on an average more than 75 lbs. Other kinds of labor, including hoeing and chopping cotton; plowing, harrowing, and planting; cultivating; picking corn, peanuts, dry peas, and other crops; other field work; and chores and housework, were reported by a large proportion of the children.

Of the 398 children between 6 and 16 years of age who had not been to school at all during the year of the study, 74 (27 white and 47 negro children) were of the compulsory school age. The 34 negro children of compulsory school age in the Hill County study who had been absent the entire year constituted 45 per cent of the negro children in their districts who were of compulsory school age. The negro children 6 to 15 years of age not attending school in Rusk County were only 4 per cent of those who were of compulsory school age. For white children in Hill County the average number of days' attendance was 76.7, for white children in Rusk County 78.9, and for negro children in Rusk 82.1. It was found that 58 per cent of the white children included in the survey in Hill County and 68 per cent of those in Rusk were retarded, while in each county an even larger proportion of the negro children had failed to make normal progress in school.

The living conditions, the work of the mothers, the diet, the literacy of parents and periodicals taken, and community life and social activities of these families were also investigated. Special attention was given to the conditions surrounding the children in migratory laborers' families.

In addition to educational measures, some public supervision of houses and sanitation is deemed desirable. The welfare of children in migratory laborers' families is said to deserve special consideration, particularly as regards their education and housing.

International yearbook of agricultural statistics for 1923 (*Inst. Internatl. Agr. [Rome], Ann. Internatl. Statist. Agr. (Internatl. Yearbook Agr. Statist.), 1923, pp. XCV+471*).—The series previously noted (E. S. R., 50, p. 393) is continued, this edition being published in both French and English.

Livestock and animal products statistics, 1923, F. J. HORNING (*Canada Bur. Statist., Livestock and Anim. Prod. Statist., 1923, pp. 101, figs. 8*).—This annual report succeeds that for the earlier year previously noted (E. S. R., 52, p. 95).

Agricultural statistics, 1923, R. J. THOMPSON ([*Gt. Brit.*] *Min. Agr. and Fisheries, Agr. Statist., 58 (1923), Nos. 1, pp. 48; 2, pp. 49-92; 3, pp. 93-137*).—These annual official reports present statistics in continuation of those previously noted (E. S. R., 49, p. 895.)

[Agricultural statistics for Denmark] (*Statist. Aarbog Danmark, 29 (1924), pp. 36-76*).—Statistics in these pages of the annual report present current information as previously noted (E. S. R., 49, p. 895).

[Agricultural statistics for Norway] (*Statist. Årbok Kongeriket Norge, 43 (1923), pp. 43-66*).—Current data in these pages supplement those presented earlier (E. S. R., 50, p. 795).

[Agricultural statistics for Sweden, 1924] (*Statist. Årsbok Sverige, 11 (1924), pp. 64-82*).—Statistics for the later year are continued as previously noted (E. S. R., 50, p. 693).

Statistical report on agricultural production in Greece for 1921 [trans. title] (*Statis. Ann. Rend. Agr. Grèce, 1921, pp. 66*).—This annual report presents tabulated data, showing the area cultivated, the production of fruits, and the number of livestock found by departments.

The statistics of agriculture, industries, and commerce, 1922, K. HIRATA ([*Japan*] *Dept. Agr. and Com., Statis. Agr., Indus., and Com., 1922, pp. [3]+7+200*).—Statistics of production and trade in Japan are given, continuing the series previously noted (*E. S. R., 49, p. 895*).

AGRICULTURAL EDUCATION

The agricultural high school in Ontario, G. McMILLAN (*Toronto: Univ. Toronto Press, 1924, pp. 129, figs. 32*).—Analyzing the replies to questionnaires submitted to students in secondary schools and to teachers, the conclusion is drawn that special schools of agriculture are not well adapted to the needs of rural Ontario at the present but that vocational departments in the existing secondary schools offer a solution of one of the Province's most pressing requirements. A course of study and curriculum are suggested. Chapters are devoted to the topics of method, accommodation and equipment, teachers' qualifications, administration and supervision, and financial support.

Courses of study at the Imperial Forestry Institute during the first year, October, 1924–September, 1925 (*Aust. Forestry Jour., 7 (1924), No. 12, p. 328*).—This program shows the distribution of studies throughout the year.

Preparation of rural teachers in high schools, M. CARNEY (*U. S. Bur. Ed., Rural School Leaflet 33 (1924), pp. 27*).—It is attempted to show what is being done throughout the United States, tracing first the origin and early history of the movement for preparing rural teachers in public high schools, describing its present status, presenting selected type studies, and setting forth the characteristic features and contributions of the various State systems.

Elementary agriculture in rural schools from sixth to eighth grades, E. H. SHINN (*Jour. Rural Ed., 4 (1924), No. 2, pp. 59–69*).—This paper discusses briefly the aims and objectives in teaching agriculture to rural pupils and the ways and means of achieving these objectives, and then presents information gathered from about 160 replies to a questionnaire sent to supervisors of rural schools, presidents of State normal schools, State supervisors of agricultural education, and heads of teacher-training divisions in land-grant colleges. Inquiries were made with reference to the State legislation which has functioned to procure for rural schools the type of education especially adapted to rural needs; the attitude of State departments of education as exhibited in policies, rulings, or encouragements which have assisted in developing rural education; the extent to which teacher-training institutions are attempting to train teachers of agriculture for rural schools; instances of effectiveness in teaching agriculture; the extent to which such teaching has helped to vitalize other school subjects of the rural school program; particular problems and difficulties; and improvements or solutions.

The author's recommendations are in favor of some agricultural instruction for the sixth, seventh, and eighth grades, although it is held that the course of study should not exclude general and cultural subjects. Opportunity should be offered to the older boys for carrying on an agricultural project. Teacher-training institutions, State departments of education, and land-grant colleges should give more attention and encouragement to the preparation of rural teachers, and closer cooperation between teachers and the numerous other agents, particularly extension workers, is urged.

Teaching home relationships, L. O. JACOBSON (*Vocat. Ed. Mag.*, 3 (1925), No. 1, pp. 27-29).—This article describes a short unit course given to a junior class in high school, in the course of which a score card was devised for judging a home on atmosphere, physical surroundings, management of the income and time, health, training and education of children, and support of community activities.

Some practical uses of auditoriums in the rural schools of Montgomery County, Ala., L. ALLEN (*U. S. Bur. Ed., Rural School Leaflet* 34 (1924), pp. 10).—The author suggests a general program coordinating school and community activities, and cites specifically a few of the programs that have been given in the rural schools of this county, including a May Day celebration and others.

Southern field crops, J. F. DUGGAR (*New York: Macmillan Co., 1925, rev. ed., pp. X+444, figs. 163*).—The author presents a revision of the textbook noted earlier (*E. S. R.*, 25, p. 297).

A study of weeds, G. E. RITCHEY (*Univ. Nanking, Agr. and Forestry Ser.*, 1 (1922), No. 5, pp. [2]+25, pls. 5, fig. 1).—A general discussion of weeds and their economic importance is presented for school use in China. Suggestions are made to teachers, and attention is given to the correlation of this with other subjects.

Animal husbandry for schools, M. W. HARPER (*New York: Macmillan Co., 1924, new and rev. ed., pp. IX+615, pl. 1, figs. 241*).—This is a revised edition of a high school and college textbook previously noted (*E. S. R.*, 29, p. 598).

4-H sheep manual, A. E. DARLOW and P. H. LOWERY (*Okla. Agr. Col. Ext. Circ.* 198 [1924], pp. [8]).—Sheep club rules are drawn up and instructions are given for the care and exhibiting of sheep by club members.

Vegetable and animal products of commercial importance, A. ASTRUC and S. CHADEFAUX (*Les Marchandises d'Origine Végétale et Animale. Paris: J. B. Baillière & Sons, 1924, pp. 444, figs. 118*).—This is a textbook describing food products, dyeing and tanning materials, perfumes, resins and vegetable secretions, drugs, textiles, and miscellaneous vegetable and animal products.

The education of the consumer, H. HARAP (*New York: Macmillan Co., 1924, pp. XXII+360*).—The effort is made to analyze into their elements food, clothing, and fuel consumption; housing; household materials requirements; and household skills in order to determine some of the actual needs of economic life. Quantitative data describing actual living conditions are brought together from direct surveys, experiments by industrial organizations and private and public investigational agencies, and trade and Government publications. This material is taken as a guide to wise educational objectives and as basic curriculum material. Present habits are compared with various standards of efficient practice.

Red Cross course in food selection (*Washington, D. C.: Amer. Red Cross, 1922, pp. 99*).—The course outlined in these 15 lessons is designed to give a knowledge of foods and food groups, as well as of the factors to be considered in selecting an adequate diet.

Sewing manual, J. F. EDDY (*Ala. Polytech. Inst. Ext. Circ.* 76 (1924), pp. 46, figs. 47).—This is planned to be used as a reference book, particularly in home demonstration extension work.

Rush work (*Rural Indus. Bur. [London] Leaflet* 16 [1925], pp. 27, figs. 19).—Information as to the preparation of rush materials and suggestions with regard to their adaptation to handicrafts and rural industries are given.

Agricultural economics laboratory manual, G. W. FORSTER (*Raleigh: N. C. State Col. Agr., 1924, pp. 47*).—A number of exercises in the graphic presenta-

tion of data illustrating some of the outstanding problems in agricultural economics are drawn up here, with considerable emphasis on the construction of index numbers.

Principles of economics, R. T. BYE (*New York: Alfred A. Knopf, 1924, pp. VII+508, figs. 22*).—Two of the 23 chapters in this textbook deal with land as a productive agent and income from land, respectively, the subject matter included following largely T. N. Carver.

The school and country life, S. B. MCCREADY (*Boston and London: D. C. Heath & Co., 1924, pp. IX+307, pls. 27, figs. 96*).—This is practically the same as the reader previously noted (E. S. R., 43, p. 195).

A list of books for a teacher's professional library, compiled by E. A. WRIGHT (*U. S. Bur. Ed., Teachers' Leaflet 17 (1924), pp. IV+15*).—This is a classified list of 100 titles of books regarded as useful to the majority of teachers. All are in English and, in most cases, are restricted to conditions existing in the United States. A few titles are to be found under the heads of rural schools and the teaching of agriculture and home economics.

Suggestions for local leaders for junior agricultural clubs, J. W. WHITEHOUSE (*Ky. Agr. Col. Ext. Circ. 177 (1925), pp. 24, figs. 5*).—Suggestions are offered as to club programs and projects and other activities. A number of games, songs, and yells for community recreation hours are given.

Organization and programs for boys' and girls' clubs, M. L. HALL (*Purdue Agr. Ext. Bul. 131 (1925), pp. 20, figs. 9*).—These suggestions apply to club meetings, types of programs, and methods of procedure.

Plans for conducting boys' and girls' 4-H club work in Missouri, T. T. MARTIN (*Missouri Agr. Col. Ext. Proj. Announc. 21 (1925), pp. 48, figs. 5*).—State and county organization of club work, ways of securing literature and supplies for club organization and projects, and suggestions with reference to programs and projects are outlined.

Small school gardens [trans. title] (*Min. Agr. [Argentina], Secc. Propaganda e Informes Circ. 333 (1924), pp. 98, figs. 58*).—This is a manual suggesting a procedure in introducing and developing school gardens in rural schools in Argentina.

MISCELLANEOUS

Elements of physical biology, A. J. LOTKA (*Baltimore: Williams & Wilkins Co., 1925, pp. XXX+460, figs. 72*).—This treatise is subdivided into sections of general principles, kinetics, statics, and dynamics. Among the chapters may be noted those on evolution conceived as a redistribution, analysis of the growth function, the water, carbon dioxide, nitrogen, and phosphorus cycles, and the energy transformers of nature. A series of synoptic charts of physical biology is appended.

Useful plants and animals of China, P. KLAUTKE (*Nutzpflanzen und Nutztiere Chinas. Hanover: Hahnsche Buchhandl., 1922, pp. 160, figs. 37*).—The author of this account, instructor in biology in the Tung Chi Medical and Technical School for Chinese in Woosung, deals in the first portion with plant geographical features, field crops, fruit culture, important plant products, and Chinese gardens and flower culture, and in the second with animal breeding, silk culture, a general review of animal life in China, and certain selected forms, concluding with a short bibliography.

Forty-fourth Annual Report of the New Jersey State Agricultural Experiment Station and the Thirty-sixth Annual Report of the New Jersey Agricultural College Experiment Station for the year ending June 30, 1923, J. G. LIPMAN ET AL. (*New Jersey Stat. Rpt. 1923, pp. XXVIII+414, pls.*

24, figs. 9).—This contains the organization list, a financial statement for the fiscal year ended June 30, 1923, a report of the director on the work and publications of the year, and departmental reports, the experimental features of which, not previously reported, are for the most part abstracted elsewhere in this issue.

Biennial Report of the Utah Agricultural Experiment Station for the years 1923 and 1924, W. PETERSON ET AL. (*Utah Sta. Bul.* 192 (1925), pp. 64, fig. 1).—This contains the organization list and a report on the work and publications of the station during the biennium ended June 30, 1924. The experimental work reported is for the most part abstracted elsewhere in this issue.

[**Reports of the director, Dominion Experimental Farms, 1923 and 1924**], E. S. ARCHIBALD (*Canada Expt. Farms, Rpts. Dir.*, 1923, pp. 82; 1924, pp. 90).—These reports, covering the fiscal years ended March 31, 1923, and March 31, 1924, respectively, include the organization lists and reports of the Central Experimental Farm and the branch farms. Field crop and livestock notes for 1922 and 1923 and a summary of meteorological observations at Ottawa for the fiscal years covered are also given.

The Quarterly Bulletin [of the Michigan Station], edited by R. S. SHAW and E. B. HILL (*Michigan Sta. Quart. Bul.*, 7 (1925), No. 3, pp. 73-118, figs. 12).—In addition to articles abstracted elsewhere in this issue, this number contains the following: Spring Fertilization of Fall Seeded Grains, by G. M. Grantham; Soil Survey Work in Michigan, by M. M. McCool; Oat Variety Tests in St. Clair County, by D. F. Rainey; Fiber Flax Production in Michigan, by C. R. Megee; A Coloring Matter for Glymol, by P. S. Lucas; and Twenty Years of Legume Inoculation, by R. M. Snyder.

Monthly Bulletin of the Ohio Agricultural Experiment Station (*Ohio Sta. Mo. Bul.*, 9 (1924), No. 11-12, pp. 185-223, figs. 14).—Five articles abstracted elsewhere in this issue are included.

Directory of field activities of the Bureau of Plant Industry (*U. S. Dept. Agr., Misc. Circ.* 30 (1924), pp. II+62, pl. 1).—A directory of the field work of the bureau, arranged by States, is given.

NOTES

Purdue University.—A tract of 360 acres of improved land in Washington, Newton County, has been transferred to the university under the will of the late Mrs. Ellen Victoria Ross Knaele. The land is subject to a life interest of her husband, but the income is to be used for the education of needy young men and women in the university.

Dr. J. C. Arthur, professor emeritus of botany, gave two lectures in April before the Pennsylvania College and the Graduate School of the U. S. Department of Agriculture, on Botany and Botanists in the Eighties, and The Rusts and Their Habits.

Ohio State University.—Dr. Thomas G. Phillips, professor of agricultural chemistry, has been appointed professor of agricultural chemistry and chemist in the New Hampshire University and Station.

Wisconsin Station.—Some surprising results are reported in experiments in the application of ultraviolet light for increased poultry production and greater hatchability of eggs, which are being carried on by the departments of agricultural chemistry and poultry. In recent trials a lot of 12 hens which were exposed to ultraviolet light for only 10 minutes daily during the month of February produced 140 per cent more eggs than a check lot which did not receive the light bath. The eggs from the hens receiving the ultraviolet light treatment were also very much higher in hatchability, over 60 per cent producing live chicks, while the average of three other lots not receiving the treatment was 28 per cent. The influence of the ultraviolet ray in stimulating the growth of the chick was as pronounced as the effect on egg production.

Work by the department of soils indicates that the use of fertilizers in the hill has a protective influence against the freezing of young corn plants. The fertilizer apparently increases the osmotic pressure of the sap in the corn plant, which in turn lowers the freezing temperature of the plant from 1.5 to 3° F. In some cases this may be sufficient to prevent plants from being frozen by late spring frosts. It is pointed out that the greatest benefit from this use of fertilizers will occur on peat and muck soils and on poor sandy soils.

Thirty-five field experiments in 14 counties on the inoculation of clover, peas, and beans are being conducted by the department of agricultural bacteriology. Special interest is being manifested in the clover inoculation trials, and reports from some of the county agents indicate that inoculation has been helpful in establishing stands of clover in sandy and extremely acid sections and on new lands where this crop had previously failed.

Northeastern Forest Experiment Station.—The work of this station is to be expanded during the coming year to include investigations of insect pests and diseases in cooperation with the U. S. D. A. Bureaus of Entomology and Plant Industry and other agencies. The investigations of insect pests are being financed in part by contributions from several individuals for a study of the white pine weevil, \$2,500 having been made available for two years

for the purpose. Studies will also be conducted of the larch sawfly and other forest insects. The plant disease work will deal especially with chestnut blight in an attempt to locate and propagate blight resistant trees, and will also take up white pine blister rust and the decay of logging slash.

High Altitude Studies in Utah.—The Brigham Young University of Provo, Utah, has had turned over to it a tract of 53 acres of land in the Wasatch National Forest, at an elevation of about 7,000 ft. The land will be used for experimental work in connection with the Alpine Summer School, which is carried on each summer for six weeks on Mount Trinpenagos, where the university erected dormitories, dining halls, and similar buildings two years ago.

Albanian-American School of Agriculture and the Mechanic Arts.—Funds are being raised in the United States for the establishment of a school of agriculture and mechanic arts in Albania. The Albanian Government has set aside a tract of 3,000 acres near Durazzo as a site for the institution. A technical school for the training of experts in agriculture, the natural sciences, and the industries is contemplated. C. Telford Erickson of New York City has been appointed president, and Dean E. E. Jones of Northwestern University a member of the board of trustees.

New Research Institute in India.—A research institute for the improvement of crops, especially cotton, was formally opened at Indore, Central India, November 24, 1924. A site of 300 acres has been leased by the Indore Durbar for 99 years at a nominal rental, and a grant of about \$75,000 has been made for capital expenditure by the Indian Central Cotton Committee. An annual grant of about \$45,000 has been provided for current expenses by the same committee and seven of the Central India States. The director of the institute will act as agricultural adviser of these States. Other features of the work in addition to research will be the development of a comprehensive library on crop production and the training of graduate students. Albert Howard, formerly Imperial economic botanist at the Agricultural Research Institute at Pusa, has been appointed director, and Mrs. Howard physiological botanist.

Agricultural Education in Australia.—The Waite Agricultural Institute has been established recently by the University of Adelaide to carry on research in agriculture. Its creation was made possible through a gift of the late Peter Waite, as pastoralist of South Australia, who left £100,000 to the university for agricultural research. This amount the Government of South Australia has supplemented by an appropriation of £5,000 per annum. The institute has been located at Glen Osmond, 3.5 miles from Adelaide, on a tract of 300 acres of good agricultural land. With the funds available, it is proposed to conduct investigations in agronomy, agricultural chemistry, plant pathology, and plant genetics.

The Government of Western Australia has authorized the establishment of an agricultural college, and an estate in the Avon Valley, one of the richest agricultural regions of the State, has been purchased for the purpose.

Proposed Graduate School of Agriculture at Harvard University.—A report of a committee appointed by the board of overseers at Harvard University to study the Bussey Institution recommends that the university establish a graduate department of agriculture. The committee estimates that an endowment of \$12,000,000 would be required to carry out this plan in an adequate way. This sum would provide \$150,000 per annum for 15 new professorships, a like sum for the maintenance of libraries and laboratories, and \$24,000 per annum for fellowships. The remainder of the endowment would be available for new laboratories, greenhouses, animal houses, and dormitory accommodations for the 400 students which the committee estimates would desire enrollment.

No action on this report has thus far been made public.

World's Forestry Congress.—The International Institute of Agriculture and the Italian Government have arranged a committee to organize a World's Forestry Congress to meet in Rome early in May, 1926. The headquarters of this committee are at the institute and its membership consists of Arrigo Serpieri, director of the Royal Higher Institute of Agriculture and Forestry at Florence, as president; Anders Fjelstad, delegate of Norway at the International Institute of Agriculture, and Dr. Alessandro Stella, director general of forests and State lands at the Italian Ministry of National Economy, as vice presidents; Ariberto Merendi, chief inspector of forests at the Ministry of National Economy, as secretary; together with Deoclecio de Campos, Gian Francesco Guerrazzi, and Asher Hobson, delegates, respectively, to the institute from Brazil, Italian Somaliland, and the United States.

An exhibition of forest products and the machinery used in their conversion will be held in connection with the International Fair at Milan. This will enable visitors to examine the different products of the wood-manufacturing industries and the wood-working machinery of the various countries.

Excursions to typical forest lands in Italy, and possibly in other countries, will be arranged to follow the sessions of the congress.

New Journals.—*Resumptio Genetica* is being published at The Hague under the editorship of Dr. J. P. Lotsy and H. N. Kooiman as an abstract journal of the current literature on genetics. The initial number contains a list of the literature and abstracts of selected articles published in 1923. Ultimately it is hoped to issue the journal monthly. The literature from 1900 to 1923 is being reviewed by subjects and issued under the title of *Bibliographia Genetica*, of which one volume of 480 pages has been printed and another is in press, with eight others in preparation.

The Journal of the Department of Agriculture of Western Australia, which was discontinued in 1909, has resumed publication as a quarterly. The initial number in the new series was issued in April, 1924, and contained an account of the organization and activities of the department of agriculture and a large number of short articles on various agricultural topics.

Agricultura is being published at Santiago de las Vegas, Cuba, as the official organ of the National Association of Agricultural Teachers. The initial number contains several short articles by the staff of the agricultural experiment station at Santiago de las Vegas, announcements, news notes, etc.

The Ministry of Agriculture of Argentina has discontinued its *Boletín del Ministerio de Agricultura* and is now issuing serially only the *Boletín Mensual de Estadística Agrícola*. Other information is to be disseminated in the form of separate bulletins.

A new series known as *Indian Medical Research Memoirs*, supplementing the *Indian Journal of Medical Research*, is being published by the Indian Research Fund Association. The initial number is devoted to a Report of the Ankylostomiasis Inquiry in Madras, by K. S. Mhaskar.

C. R. E. A. Bulletin is being published by the Committee on the Relation of Electricity to Agriculture. The initial number contains numerous brief notes, including one by the editor, E. A. White, on the committee's investigational program.

Abstracts of Canning Technology is being published as a quarterly by the National Cannery Association. The initial number contains abstracts or title references to 436 articles published in 1922, together with a list of the publications abstracted.

Journal of Oil and Fat Industries is being published by the American Oil Chemists' Society as a quarterly. The initial number is devoted mainly to the proceedings of the fifteenth annual convention.

Necrology.—Mark A. Carleton, with the U. S. Department of Agriculture from 1894 to 1918, and cerealist from 1900 to 1918, died recently in Peru, where he had gone some months previously in the service of a cotton growers' association, located at Piura. Mr. Carleton was born at Jerusalem, Ohio, March 7, 1866, graduating from the Kansas College in 1887 and receiving the M. S. degree there in 1893. While in the service of this Department, he served as explorer in Russia and Siberia, bringing back a number of durum wheats of much value. He was the author of *The Small Grains*, published in 1916.

G. M. Murgoci, chief of the agrogeological section of the Geological Institute of Rumania and professor in the Polytechnic School of Bucharest, died March 5 at the age of 53 years. He was president of the International Commission on Soil Mapping and director of the International Pedological Charts of Europe.

Professor August von Wassermann, eminent for his studies of immunity and related problems, died in Berlin, March 6, at the age of 60 years.

Miscellaneous.—*Science* announces that an anonymous friend of plant physiology has provided a temporary endowment to aid the newly organized American Society of Plant Pathologists. The principal given is approximately \$20,000, and the income, which is assured for three years beginning July 1, 1925, is to be used in aid of any enterprise the society may foster.

A recent note in *Nature* states that the foundation stone of the Cotton Technical Research Laboratory for India was laid December 3, 1924, by the Viceroy of India. At the same time he opened an experimental spinning mill, the equipment for which had been presented by Lancashire manufacturers. A. J. Turner, professor of textiles in the College of Technology, Manchester, has been appointed director of the laboratory.

The first agricultural college in Burma was opened at Mandalay December 22, 1924. A farm of 600 acres and facilities for a four-year course for 84 students have been provided. Special attention is to be given to the selection of better varieties of rice, beans, cotton, and sugar cane, the study of plant diseases, silk culture, and the building up of a pedigreed herd of pure Burma cattle.

The Ministry of Agriculture of France is establishing an Agronomic Research Institute at Clermont-Ferrand. Laboratories will be provided for plant studies from the standpoint of agricultural botany, genetics, pathology, entomology, etc. M. Crépin has been appointed director of the institute.

The retirement is noted of Dr. C. F. Juritz, chief of the division of chemistry of the Department of Agriculture of the Union of South Africa, terminating a prolific service, mostly under pioneer conditions, of about 35 years.

Dr. Robert L. Pendleton, director of agriculture in Gwalior State, India, has been appointed professor of soil technology at the University of the Philippines and in charge of the work in soils in the department of agronomy.

The retirement under a new pension law is reported of John R. Bovell, director of agriculture, Barbados, and in the service of the department since 1883.

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RECENT WORK IN AGRICULTURAL SCIENCE

AGRICULTURAL CHEMISTRY—AGROTECHNY

Observations on the mechanism of the reaction between formaldehyde and serum proteins, R. R. HENLEY (*Jour. Agr. Research* [U. S.], 29 (1924), No. 10, pp. 471-482, figs. 2).—In this investigation of the changes which take place in the proteins of formolized serums, the effect of formaldehyde on the precipitation limits of pure globulins and albumins was first determined.

It was found that in the presence of 0.18 per cent formaldehyde pure native pseudoglobulins behaved as if they were converted into euglobulins and pure native albumins into pseudoglobulins. With larger amounts of formaldehyde euglobulins were produced from albumins. The reactions resulting in these changes are thought to be of the second order. Determinations of the titratable acidity showed a primary increase in acidity related but not proportional to the amount of formaldehyde. This was followed by a general decline. The pH values determined at the same intervals showed a steady decrease.

In discussing these results and the results of other investigations along the same line, the mechanism of the changes taking place in the proteins of formolized serum is suggested to be as follows: In the first stage of the reaction, which is accompanied by increased acidity, the formaldehyde may attack certain basic groups of the protein molecule, as a result of which the protein molecule becomes acid. The second stage of reaction, in which there is a decrease in titratable acidity, is attributed to the reaction between the acid protein molecules formed in the first stage of the reaction and the enol group, —C(OH)=N— , or similar linkages. "This explanation of the mechanism of the changes which take place in the proteins of formolized serum is offered simply as a suggestion and with the full realization that the results presented herein are not sufficient to warrant at the present time a final conclusion."

A list of 16 references to the literature is appended.

Total ash determination in spices, A. L. MEHRING (*Jour. Agr. Research* [U. S.], 29 (1924), No. 11, pp. 569-574).—This contribution from the Bureau of Animal Industry, U. S. D. A., consists chiefly of a compilation of data from the literature and from hitherto unpublished determinations made by J. B. Martin and by the author on the total ash of various spices. In the case of 31 of the more common spices, the data presented consist of weighted averages for from 14 to 841 samples each as determined by from 2 to 23 analysts. Data averaged from a few determinations on each variety are also given on the ash content of 12 other spices used in powdered form and on the composition of the ash of 9 spices. A classified bibliography of 111 titles is appended.

A protein from the leaves of the alfalfa plant, A. C. CHIBNALL and L. S. NOLAN (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 173-178).—The authors have obtained from fresh alfalfa leaves by the method previously described for the preparation of spinacin from spinach leaves (*E. S. R.*, 52, p. 708) a protein resembling spinacin in its chemical and physical properties, particularly its sensitiveness to the presence of salts when in weak acid solution. The Van Slyke analysis of the protein after hydrolysis with 20 per cent HCl for 27 hours gave the following results: Amide N 5.51 per cent, humin N in acid 1.22, humin N in lime 1.46, humin N in amyl alcohol 0.04, cystine N 0.84, arginine N 15.32, histidine N 3.09, lysine N 9.97, amino N in filtrate 53.56, and non-amino N in filtrate 3.19 per cent.

A protein from the leaves of Zea mays, A. C. CHIBNALL and L. S. NOLAN (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 179-181).—A protein similar to that obtained from the cytoplasm of alfalfa and spinach leaves has been obtained from the cytoplasm of the leaves of silage corn. The Van Slyke analysis of the protein after hydrolysis with 20 per cent HCl for 28 hours gave the following results: Amide N 7.44 per cent, humin N in acid 1.91, humin N in lime 2.47, humin N in amyl alcohol 0.19, cystine N 0.77, arginine N 14.69, histidine N 4.70, lysine N 8.78, amino N 55.81, and non-amino N 2.04 per cent.

The tryptophane and cystine content of various proteins, D. B. JONES, C. E. F. GERSDORFF, and O. MOELLER (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 183-195).—A large number of proteins, including those isolated by the authors in their extensive series of protein investigations and others specially prepared for the present study, were analyzed colorimetrically for their cystine content by the method of Folin and Looney (*E. S. R.*, 47, p. 504) and for tryptophan by the method of May and Rose (*E. S. R.*, 48, p. 312). In the latter determination, the calculations were made on the basis that the casein used as a standard contained 2.2 per cent of tryptophan. The results are reported in tabular form, and a tabular comparison is included of the cystine content of certain proteins as determined by the colorimetric and the Van Slyke methods. In a large number of cases the results obtained by the two methods agreed fairly closely.

Of particular interest in the data reported are the high percentages of tryptophan and cystine in the proteins of wheat bran. The tryptophan content of the albumin of wheat bran (4.76 per cent) is said to be the highest yet reported for any plant protein. This protein also contained a high percentage of cystine, 3.29 per cent. The globulin of wheat bran contained 2.85 per cent of tryptophan and 1.52 per cent of cystine. Since albumin and globulin in approximately equal proportions make up about half of the proteins of wheat bran (*E. S. R.*, 50, p. 711), the nutritive value of wheat bran assumes an added importance.

The globulin of the almond was found to contain much less tryptophan and cystine, 1.37 and 0.85 per cent, respectively, than the corresponding proteins of Brazil nuts 2.59 and 1.84, the English walnut 2.84 and 2.18 and coconut 1.25 and 1.54 per cent, respectively. This is in agreement with the results of feeding experiments reported by Morgan, Newbecker, and Bridge for almond proteins (*E. S. R.*, 50, p. 857), Osborne and Mendel for the excelsin of Brazil nuts (*E. S. R.*, 33, p. 262), Mignon for the globulin of English walnuts (*E. S. R.*, 50, p. 462), and Johns, Finks, and Paul for the coconut globulin (*E. S. R.*, 41, p. 262).

Other points brought out in the discussion of the data are the high tryptophan content of the proteins of the oil seeds, the higher content of both trypto-

phan and cystine in α - than β -globulins, and the high content of cystine in lactalbumin (4.25 and 3.91 per cent in two determinations).

A list of 49 references to the literature is appended.

A method for the fractional analysis of incomplete protein hydrolysates, H. WASTENEYS and H. BORSOOK (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 1-14, fig. 1).—"Briefly, the method involves the precipitation of the protein by trichloroacetic acid, of the metaprotein by careful adjustment of the reaction, of the proteoses by Na_2SO_4 at 33° C., of the peptones by tannic acid under definitely fixed conditions; and the determination of the residual amino acids and simple peptides by a slight modification of the alcohol precipitation methods of Folin and Denis and Van Slyke and Meyer. No new principle is introduced, but quantitative results with these reagents were found to be obtainable only under rigidly fixed conditions. The metaprotein fraction is determined on a separate aliquot of the original solution. For the assay of the other five fractions 100 cc. are required, containing not less than 200 mg. of nitrogen. The amount of each fraction is estimated by the nitrogen content, obtained by difference before and after filtration."

A note on Dakin's method as applied to edestin, T. B. OSBORNE, C. S. LEAVENWORTH, and L. S. NOLAN (*Jour. Biol. Chem.*, 61 (1924), No. 2, pp. 309-313).—A slight modification in the technique of the original Dakin butyl alcohol method of extracting the monamino acids from the products of protein hydrolysis is described, and its application to the analysis of edestin discussed. The modification consists in dropping the solution of the amino acids at room temperature into a tall jar containing a large amount of butyl alcohol and keeping the mixture agitated by stirring with an electric stirrer. The process is generally repeated and the butyl alcohol evaporated in vacuo in portions of about 1,500 cc.

Using the modified method on edestin, no oxyglutaminic acid was obtained. In view of unpublished experiments showing that satisfactory growth can be obtained on edestin as the sole source of protein, it is concluded that oxyglutaminic acid is not essential for adequate nutrition. From the proline fraction a crystalline substance was obtained which was identified as a diketopiperazine. It is pointed out that on account of the presence of this substance the Van Slyke method can not be used to estimate the proline from the imino nitrogen soluble in alcohol unless the diketopiperazines are hydrolyzed or the proline is esterified as recommended by Dakin.

The optical properties of some amino acids, G. L. KEENAN (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 163-172, figs. 11).—With the use of the immersion method described by Wherry (*E. S. R.*, 39, p. 415), the author has determined the optical properties of alanine, aspartic acid, cystine, glutamic acid, synthetic glycocoll, leucine, phenylalanine, serine, tryptophan, tyrosine, and valine. The data reported include crystal habit, refractive indices, characters shown in parallel and convergent polarized light with crossed Nicols, and diagnostic characters. Photomicrographs of the acids are also given.

A contribution to the chemistry of grape pigments.—III, Concerning the anthocyanins in Seibel grapes, R. J. ANDERSON (*Jour. Biol. Chem.*, 61 (1924), No. 3, pp. 685-694).—In continuation of the studies previously noted (*E. S. R.*, 52, p. 610), a similar examination was made of the anthocyan occurring in the dark blue Seibel grape. As determined by the composition of the anthocyanin chloride and the anthocyanidin chloride, the anthocyan was identified as oenin, the glucoside derived from *Vitis vinifera*, thus showing that in this cross between the American varieties *V. aestivalis* and *V. rupestris* and the European variety *V. vinifera* the pigment of the European grape is inherited by the hybrid.

Insulin from the cod fish.—The direct application of picric acid to the islet tissue, H. W. DUDLEY (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 665-668).—A convenient method is described for collecting and preserving the islet tissue of the pancreas of cod for the preparation of insulin. The method consists in removing the tissue from freshly cut fish and dropping it immediately into saturated aqueous picric acid. The material, which can be kept without refrigeration, is worked up by pouring off the picric acid solution into a convenient receptacle, cutting up the tissue with scissors, grinding it in a mortar with sand, and returning it to the picric acid. After standing for a day, the material is filtered and the picric acid solution discarded. The tissue is then ground repeatedly in a mortar with small amounts of a 75 per cent aqueous solution of acetone (150 cc. of the acetone being used for 9.6 gm. of the moist tissue), centrifuged, and the picrate converted into a soluble hydrochloride by the method previously described (E. S. R., 51, p. 502).

It is stated that a yield of 13.12 rabbit units per gram of tissue was obtained by this method from the islet tissue of the cod, although collected from fish which had been caught at varying intervals up to 24 hours before the extraction. It is estimated that the islet tissue of the cod contains, weight for weight, about 10 times as much insulin as mammalian pancreas.

Studies on pentose metabolism.—I, A colorimetric method for the estimation of furfural, G. E. YOUNGBURG and G. W. PUCHER (*Jour. Biol. Chem.*, 61 (1924), No. 3, pp. 741-746).—The method described is based upon the reaction between furfural and aniline in the presence of acetic acid. The technique is essentially as follows:

From 1 to 5 cc. of the distillate or reaction mixture to be tested, diluted if necessary so that 2 cc. contains between 0.01 and 0.05 mg. of furfural, is pipetted into a tube calibrated at 10, 15, and 20 cc., and to this as well as to two similar tubes are added from 1 to 2 drops of a 0.5 per cent alcoholic solution of phenolphthalein. Into one tube containing only the phenolphthalein is pipetted 1 cc. of a standard solution containing 0.02 mg. of furfural in toluene-saturated water, and to the other 1 cc. of a similar standard containing 0.05 mg. To each of the tubes is then added, drop by drop from a capillary pipette, 50 per cent sodium hydroxide until a permanent pink color is obtained, after which exactly 0.5 cc. of aniline and 4 cc. of acetic acid are added. The contents of each tube are diluted to 10 cc. with distilled water, thoroughly mixed, and the tubes are allowed to stand in diffused light or in the dark for 15 minutes, after which they are compared in a colorimeter with the standards.

Data are given showing that the new method gives results in close agreement with those obtained by the Official gravimetric phloroglucinol method and slightly lower than those obtained with the Pervier and Gortner electrometric method (E. S. R., 51, p. 12).

Fat-soluble vitamins.—XX, A modified technique for the determination of vitamin A, H. STEENBOCK, M. T. NELSON, and A. BLACK (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 275-286, pl. 1, figs. 4).—The evidence advanced in a previous paper of the series (E. S. R., 50, p. 363) that the growth-promoting properties of what has been known as the fat-soluble vitamin are really due to both the antiophthalmic vitamin (vitamin A) and the antirachitic vitamin is thought to necessitate a revision of methods of determining vitamin A which have used growth as the criterion for the quantitative occurrence of this vitamin.

By irradiating the experimental animals, failure to grow as the result of lack of antirachitic vitamin is avoided, and the continued growth or failure to grow after a certain period is a measure of the presence or absence of

vitamin A. Data are reported in tables and charts illustrating the use of the modified method. In determining the vitamin A content of millet seed and of alfalfa, the former was found to contain considerable quantities of vitamin A but to be deficient in antirachitic vitamin. Alfalfa cured in the dark was found to be rich in vitamin A, but when cured in the sun to be deficient in vitamin A but to contain the antirachitic factor.

Vitamin studies: The water-soluble growth-promoting factors.—I, The quantitative determination of the growth-promoting factor for bacteria [trans. title], H. DAVIDSOHN (*Biochem. Ztschr.*, 150 (1924), No. 3-4, pp. 304-336, figs. 3).—This paper consists of an extensive review of the literature on the water-soluble vitamins, the report of a study of various methods of determining quantitatively the growth-promoting substance for bacteria, with the development of a new method for this determination, and a theoretical discussion of the possible use that can be made of this method.

An examination of various bacteria led to the selection of *Bacillus coli* as best suited for the purpose. The method finally adopted consisted essentially in measuring the growth induced in this organism by the degree of turbidity produced in a given suspension under specified conditions. The standard fixed for comparative determinations was the amount of the substance to be tested which would give, after four hours' incubation at 37° C. with a given amount of *B. coli*, double the turbidity produced by the control without the added substance.

A list of 34 references to the literature is appended.

A critical study of the Jendrassik reaction for water-soluble B, V. E. LEVINE (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 157-161).—The ferric ferri-cyanide reaction considered by Jendrassik to be specific for vitamin B (E. S. R., 50, p. 506) is reported to be positive for nearly all phenols and also for certain nonphenolic compounds. Negative results were obtained with phenols following reaction with alkali, as was shown by Jendrassik to be the case with preparations containing vitamin B. Negative results were also obtained with certain organic acids, aldehydes, ketones, and carbohydrates.

It is concluded that the test is not specific for vitamin B, but that it suggests the possibility that the vitamin B molecule may contain one or more phenolic groups.

Cod-liver oil and its by-products, A. D. HOLMES (*Jour. Amer. Pharm. Assoc.*, 13 (1924), No. 12, pp. 1112-1115, fig. 1).—A general description is given of modern methods of manufacturing medicinal cod liver oil and its by-products, with special emphasis on the variations in the vitamin content of the oil, depending upon whether it is rendered from fresh livers or prepared by the rotting process or by renovating nonedible oils.

The chemistry of synthetic sweetening compounds, G. M. DYSON (*Chem. Age [London]*, 11 (1924), No. 286, pp. 572-574).—This is a review of present theories concerning the correlation of the sweetness of certain synthetic organic compounds, such as saccharin, with their structure. The method of manufacturing saccharin is also outlined.

Merck's catalogue of reagents, E. MERCK (*Merck's Reagenzien-Verzeichnis. Darmstadt: L. C. Wittich*, 1924, 5. ed., pp. [6]+656).—This volume, of which this is the fifth edition, contains an extensive list of chemical reagents and reactions classified under the authors' names, with brief descriptions of the preparation and use of the reagents and of the technique and significance of the reactions and references to the original literature. At the end of the volume the reagents and reactions described are arranged according to subjects, with cross references to the authors.

A systematic handbook of volumetric analysis, F. SUTTON, rev. by W. L. SUTTON and A. E. JOHNSON (*Philadelphia: P. Blackiston's Son & Co., 1924, 11. ed., rev. and enl., pp. XII+629, figs. 120*).—In the preparation of the eleventh edition of this well-known volume every section has been thoroughly revised, and the section on gas analysis has been entirely rewritten by H. Hollings and J. S. G. Thomas.* The International Atomic Weights for 1923 have been used throughout and all factors recalculated where necessary.

A method for the quantitative determination of ammonium salts [trans. title], S. LOVGREN (*Ztschr. Analyt. Chem., 64 (1924), No. 12, pp. 457-470*).—The author recommends for the determination of ammonium salts direct titration with sodium hydroxide in the presence of alcohol, with thymolphthalein as indicator. To obtain accurate results, the concentration of alcohol at the end of the experiment must be at least 50 per cent and the total volume not more than 10 cc. The method is considered applicable to the determination of small as well as large amounts of ammonium salts of either strong or weak acids. The strength of the base must correspond to that of the salt being titrated.

An iodometric method for the determination of sodium in small amounts of serum, B. KRAMER and I. GITTLEMAN (*Jour. Biol. Chem., 62 (1924), No. 2, pp. 353-360*).—On account of the unsatisfactory results reported by some investigators in the use of the gravimetric method of determining sodium described by Kramer and Tisdall (*E. S. R., 45, p. 716*), the authors have further modified the procedure by determining the antimony in the precipitate by iodometric titration. The various steps in the procedure are outlined as follows: "First, the precipitation of the sodium as the pyroantimonate compound; second, the separation of the supernatant fluid from the precipitate by centrifuging, followed by either siphoning or careful aspiration of all the supernatant fluid; third, the solution of the precipitate by means of an excess of concentrated hydrochloric acid or the acidification of the supernatant fluid with resolution of the precipitate that forms; fourth, the reduction of antimonite ion with a simultaneous oxidation of the iodide ion of hydriodic acid to free iodine; and lastly, the reduction of free iodine to iodide ion by sodium thiosulfate with the formation of sodium iodide and sodium tetrathionate."

The chemical reactions involved are discussed, and data are reported on various analyses, indicating the degree of accuracy of the method. The maximum error is considered to be ± 2 per cent.

The graphic determination of carbon dioxide output and the respiratory quotient with the differential spirometer [trans. title], E. HELMREICH and R. WAGNER (*Biochem. Ztschr., 149 (1924), No. 5-6, pp. 560-565, figs. 3*).—A further discussion of the apparatus previously noted (*E. S. R., 51, p. 806*).

On the determination of sugar in small amounts of blood, M. GILBERT and J. C. BOCK (*Jour. Biol. Chem., 62 (1924), No. 2, pp. 361-369, fig. 1*).—In the method described the samples of blood are collected in specially prepared capillary tubes and weighed on a torsion balance. The contents of the tubes are then aspirated into water in precipitation tubes of special design, and the determination is made by a modification of the Folin-Wu method adapted to small amounts of blood.

The nature of the sugar in normal urine.—I, A comparison of the glucose equivalent of various sugars in different methods for the determination of glucose, I. GREENWALD, J. SAMET, and J. GROSS (*Jour. Biol. Chem., 62 (1924), No. 2, pp. 397-399*).—The data obtained in a comparison of various methods of determining the glucose equivalent of 1 mg. of various pure sugars are reported in the accompanying table. Attention is called to the fact that the amounts of sugar were so chosen as to bring the depth of color

or the amount of titrated material within the prescribed range, and that, since the glucose equivalent in general varies with the concentration of the sugar, the values obtained are only approximately correct and are not applicable to all concentrations.

Comparison of the reducing action of various sugars with that of glucose

Sugar	Glucose equivalents of 1 mg. of sugar					
	Methods					
	Folin-Wu	Shaffer-Hartmann	MacLean	Benedict and Osterberg		Sumner
				Na ₂ CO ₃	NaOH	
	Mg.	Mg.	Mg.	Mg.	Mg.	Mg.
Xylose.....	0.94	0.96	0.83	1.09	1.28	1.14
Arabinose.....	.80	.80	.80	1.02	1.17	1.17
Fructose.....	.91	.90	.94	.96	1.08	1.00
Galactose.....	.75	.80	.77	.95	1.04	.95
Mannose.....	.58	.81	.93	1.08	.86	.76
Maltose.....	.40	.42	.46	.82	.77	.70
Lactose.....	.45	.53	.51	.78	.74	.70
Glucosamine.....	.92	.90	.95	.98	.54	.34

The Benedict and Osterberg sodium carbonate, MacLean, Folin-Wu, Shaffer-Hartmann, and Benedict-Osterberg sodium hydroxide methods have all been noted (E. S. R., 39, p. 112; 41, p. 505; 42 p. 712; 45, p. 111; 46, p. 417).

Analytical methods and observations on the organic phosphorus of the urine. G. E. YOUNGBURG and G. W. PUCHER (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 31-44, fig. 1).—The authors, with the technical assistance of H. A. Day, have examined various methods of determining the organic phosphorus of the urine by the removal of inorganic phosphates by precipitation and the subsequent estimation of the organic phosphorus in the filtrate.

Of the various precipitants magnesium mixture was selected as the most satisfactory, and for the subsequent determination of the organic phosphorus a modification of the colorimetric method of Bell and Doisy (E. S. R., 44, p. 613). The filtrate is digested with sulfuric and nitric acids in a Pyrex test tube (200 by 25 mm. and graduated at 25 cc.), with copper sulfate added to hasten the decomposition and to serve as indicator in the subsequent neutralization with ammonia. To obtain the same degree of acidity in the unknown and standard solutions the cooled mixture is diluted, neutralized with phosphorus-free ammonia water, and reacidified. The rest of the procedure is the same as the original Bell-Doisy method, except that the mixture is kept throughout the experiment in the same tube and finally made up to 25 cc. and compared in the colorimeter.

The method is admitted to give low results on account of the loss of phosphorus in the digestion with acids. Efforts to overcome this loss have thus far been unsuccessful. The losses of phosphorus in urine on standing for two days were found to be within the limits of experimental error.

Data are reported on the organic phosphorus excretion of 12 medical students (males) for 24 hours in 2-hour periods. The amounts excreted by the same subject fluctuated considerably, variations of over 100 per cent being obtained in successive 2-hour periods. The minimum, maximum, and average figures obtained were 0.089, 0.187, and 0.131 mg. per kilogram in 24 hours.

METEOROLOGY

Climatic laws, S. S. VISHER (*New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd.*, 1924, pp. 96, figs. 9; rev. in *Amer. Jour. Sci.*, 5. ser., 9 (1925), No. 1, pp. 78, 79).—This book gives 90 generalizations as to the geographic distribution and variation of temperature, wind, moisture, and miscellaneous phenomena.

The laws of winds and moisture, S. S. VISHER (*Ann. Assoc. Amer. Geogr.*, 13 (1923), No. 4, pp. 169–207).—The laws concisely formulated, with references to the literature, relate to kinds, direction, velocity, and steadiness of winds; sources of moisture; rate of evaporation; distribution of moisture; relative humidity; condensation; and precipitation with reference to kind, place distribution, diurnal and seasonal distribution, and annual variability.

Effects of tropical cyclones upon the weather of mid-latitudes, S. S. VISHER (*Geogr. Rev.*, 15 (1925), No. 1, pp. 106–114).—This article presents evidence and arguments to support the hypothesis “that tropical disturbances, particularly tropical cyclonic disturbances, give rise to many of the irregular weather changes of the rest of the world.” It is stated that “the effects of tropical cyclones upon the weather of mid-latitudes are both direct and indirect. The direct effects are partly the same as those produced within the Tropics and are partly different. Among those that are the same, mention may be made of the changes in air pressure, wind direction and velocity, cloudiness, humidity, and precipitation.” The indirect effects “are of three main types, those due to disturbances in the normal planetary circulation, those due to disturbances in the so-called permanent ‘centers of action,’ and those due to the influence of the tropical storms themselves upon other cyclones in middle latitudes.”

[Fluctuations in solar radiation and their relation to weather] (*Smithson. Misc. Collect.*, 76 (1924), No. 10, pp. 22–30, figs. 4; abs. in *Jour. Franklin Inst.*, 198 (1924), No. 6, pp. 848–850).—Observations at Mount Wilson, Calif. (later at Mount Harqua Hala, Ariz.), and at Calama, Chile (later at Mount Montezuma), of the same character as those already noted (*E. S. R.*, 50, p. 509), are reviewed. “The two stations join in indicating the march of the solar heat up and down, and within the past year the fluctuations have ranged over about 4 per cent. During the years 1914 to 1921, the results had run generally at a level of about 1.95 calories per square centimeter per minute. Beginning in 1921, a notable downward march began, and by September, 1922, the monthly mean values were ranging at about 1.91. This lower level continued, with minor fluctuations, for a number of months, and the lowest values were reached in February and March, 1922. After that there was a gradual increase, until in September and early October, 1923, the values had come to an average level of about 1.93. Still more recently, there has begun a slump, so that at latest advices, up to February 1, 1924, the solar heat outside the atmosphere is running at approximately 1.92 calories.”

It is explained that there is no simple relation between fluctuations in solar radiation and rise or fall of temperature. “Consequently the study of the dependence of weather on solar radiation must be very long continued and thorough before it will be possible to hazard predictions based upon the variation of the sun, or even to know for certain that the variations of the sun are of importance for our forecasters.”

Atmospheric electric currents, normal and abnormal, and their relation to the growth of plants, V. H. BLACKMAN (*Quart. Jour. Roy. Met. Soc. [London]*, 50 (1924), No. 211, pp. 197–207, figs. 2).—Reviewing the work of others and summarizing the results of field, pot, and laboratory experiments of

his own at Rothamsted, the Harper Adams Agricultural College, and Lincuden, Scotland, extending over several years, the author concludes in brief "that although no indubitable evidence has been obtained as to the favorable effect of the normal atmospheric current, yet the converging evidence now available from the laboratory, from pot cultures, and from the field can leave no doubt as to the favorable effect on the growth of plants which larger electrical discharges are able to produce," and he expresses the opinion "that in the biological effects of atmospheric electric currents we have a field of exploration of importance to both pure and applied science."

Influence of meteorological factors on tree growth.—I, Influence on the trunk circumference of a fir tree [trans. title], H. NAKASHIMA (*Jour. Col. Agr., Hokkaido Imp. Univ.*, 12 (1924), No. 2, pp. 69–263, pls. 14, figs. 3).—Observations with a Friedrich "growth autograph" (Zuwachsautograph) on a representative 50-year-old fir (*Abies mayriana*) growing on a deep, well-drained loam soil are recorded and discussed in detail. The growth measurements extended over a period from November 15, 1913, to December 31, 1918, and were accompanied by observations on soil and air temperature, precipitation, evaporation, humidity, cloudiness, sunshine, and wind.

The results showed two causes of change in trunk circumference, namely, growth, and swelling or contraction of the water-carrying tissue. A close relation with meteorological conditions was evident. Four periods are differentiated, vegetative, spring transition, fall transition, and rest. During the rest period, temperature was the controlling factor, in the vegetative period, precipitation. In the transition periods, the ratio of transpiration to absorption was the determining factor.

The relation between air temperature and circumference during the rest period is expressed as follows:

$$y = 0.66359 - 0.086265(2 - x) - 0.2$$

The relation between rainfall and trunk circumference during the vegetative period is represented by the following equation:

$$y = 0.055 - 0.02785(x + 0.5) - 0.41797$$

Some aspects of the use of the annual rings of trees in climatic study, A. E. DOUGLASS (*Smithsn. Inst. Ann. Rpt.*, 1922, pp. 223–239).—This article is reprinted from a source already noted (*E. S. R.*, 47, p. 510).

The temperature region map, A. E. PARKINS (*Abstr. in Ann. Assoc. Amer. Geogr.*, 13 (1923), No. 4, pp. 214, 215).—This is an abstract of a paper presented at the Ann Arbor meeting of the Association of American Geographers, in which was briefly reviewed the development of the idea of temperature regions and a comparison made of various temperature region maps, the merits of a map proposed by the author being explained.

Rainfall map of Sweden [trans. title], A. WALLÉN (*Meddel. Statens Met. Hydrog. Anst.*, Bd. 2, No. 3; rev. in *Nature* [London], 114, (1924), No. 2868, p. 588).—The map shows annual and monthly rainfall based on data from widely distributed stations for 1881 to 1920, with a summary of the data used and a discussion of the cartographic methods employed.

[Heaviest rainfall ever recorded on the Island of Guam] (*Guam Recorder*, 1 (1924), No. 8, p. 5).—A typhoon passing to the south of Guam on October 1, 1924, was accompanied by a rainfall on the island of 19 in. in 15

hours, 28.25 in. in 30 hours, and 33.09 in. in 48 hours. This is the heaviest rainfall recorded for the island and resulted in floods which did much damage.

SOILS—FERTILIZERS

The moisture equivalent as influenced by the amount of soil used in its determination, F. J. VEIHMEYER, O. W. ISRAELSEN, and J. P. CONRAD (*California Sta. Tech. Paper 16 (1924), pp. 64, pls. 2, figs. 10*).—Studies of the influence of the amount of soil used in the determination of the moisture equivalent in five different soils are reported.

The results showed that the amount of soil used materially influences the moisture equivalent, the smaller the sample the larger the percentage of water retained. The difference was greater with small samples than with large ones. Some clay soils were found to become impermeable to water during centrifuging when the amount of soil placed in the centrifuge cup was increased, and these soils reabsorbed the supernatant water when the centrifugal force was relieved.

The moisture content was found to increase from the inner to the outer surface of a 60-gm. block of soil, but the rate of increase was lower than that resulting from reducing the size of sample from 60 to 5 gm. The amount of water retained within blocks of soil much larger than 60 gm. probably increases from the inner to the outer surface if the soil is centrifuged long enough to establish equilibrium. The apparent specific gravity of a 60-gm. block of soil was found to be significantly greater than that of a 10-gm. block, and decreased continuously as the size of sample was decreased from 60 to 10 gm. The apparent specific gravity within a 60-gm. sample increased significantly from the inner surface outward to a point about 6 mm. within the sample, beyond which it remained substantially constant to the outer surface.

The placing of weights on the inner surface of 5-, 10-, 20-, or 30-gm. samples decreased the amount of water retained by the soil. Subjecting the moist soil to centrifugal force until the moisture was in equilibrium with this force resulted in the establishment of an equipotential region throughout the block of soil. In general, it was found that the average pore space does not limit the amount of water retained by the soil block, and it is considered probable that the outer layer of the fine-textured soils is saturated, or nearly so.

When precision is desired, it is considered necessary to measure the sample by weight rather than by the measuring cup. The variation in moisture equivalent with samples of different sizes was found to be influenced by the degree of compactness as well as by the depth of the sample in the centrifuge cup. The results as a whole are taken to indicate that further standardization of the moisture equivalent method is necessary if comparable results are to be obtained.

The reservoir capacity of soil [at the Irrigation Substation], C. C. WRIGHT (*Washington Col. Sta. Bul. 187 (1924), pp. 101, 102*).—Studies of the reservoir capacity of six plats of the substation soil at depths of from 1 to 6 ft. showed that the water-holding capacity and rate of water penetration of the soil in the six plats was very uniform. This soil was found to hold as much as 3.5 in. of water per foot when saturated in the field and 2.5 in. per foot under conditions of equilibrium after being thoroughly irrigated, thus indicating that the upper soil blanket of 6 ft. will hold 15 in. of water before any loss by deep percolation takes place. It was further found that this soil must contain 0.5 in. per foot in order to have any water available for crops. Irrigation of from 2 to 3 in. every 20 days was required to keep this soil restocked with water during the irrigation season where there were no crop demands upon it.

Thermal diffusivity and conductivity of some soil materials, L. R. INGERSOLL and O. A. KOEPP (*Phys. Rev.*, 2. ser., 24 (1924), No. 1, pp. 92, 93).—The results of thermal diffusivity determinations of quartz sand, sandy clay, calcareous earth, and packed snow are briefly reported. The method used is based on the principle of linear heat flow in a slab whose faces are suddenly chilled. The material was packed in a narrow sheet copper box having broad faces, with a resistance thermometer in the center. After standing at room temperature for two days it was placed in stirred ice water and the time required for the temperature to fall half way to zero was noted, thus allowing direct calculation of the diffusivity. It is noted that where comparison of the values found with existing data is possible, the agreement is satisfactory.

The results showed that sandy clay gave the highest result of the earthy materials and the calcareous earth and quartz sand the lowest. The densely packed snow gave the highest result of all the materials.

The chemistry and physics of clays and other ceramic materials, A. B. SEARLE (*New York: Van Nostrand Co.*, 1924, pp. XIII+695, figs. 52).—This book, while prepared primarily from the ceramic standpoint, contains a large amount of information relating to the chemistry and physics of clays which should be of value in a study of soils and soil dynamics.

The electrical charge on a clay colloid as influenced by hydrogen-ion concentration and by different salts, W. C. DAYHUFF and D. R. HOAGLAND (*Soil Sci.*, 18 (1924), No. 5, pp. 401-408).—In a contribution from the University of California the results of measurements made of the cataphoretic charge on a clay colloid as influenced by varying H-ion concentrations and by varying salts are reported.

It was found that the colloid remained negatively charged within the entire range of H-ion concentrations used, namely, from pH 2.1 to pH 12.7. The predominant factors determining the stability of the suspension were the nature and the concentration of the cations present in the medium. It is suggested that an alkaline reaction may sometimes cause deflocculation primarily because of the lessened solubility of di- and trivalent cations rather than because of the direct effect of the OH-ion concentration.

A study of the tolerance of plants to acid conditions as determined by the hydrogen ion concentration, L. W. TARR (*Delaware Sta. Bul.* 139 (1925), pp. 15, 16).—It is stated that preliminary experiments conducted with a sand, clay loam, and a muck soil showed that soils differ materially in their resistance to change in reaction. The addition of small amounts of acid or alkali to the sand produced appreciable changes in reaction, whereas the muck resisted an appreciable change in reaction even upon the addition of relatively large amounts of acid or alkali. This is taken to indicate that the buffer action of the sand is slight, while that of the muck is considerable. The clay also exhibited considerable buffering effect. It is thought that the organic matter in some soils is undoubtedly a considerable factor in offering resistance to a change in reaction, and in others is due to colloidal iron, alumina, and silica. An effort is being made to correlate the buffer action observed with the colloidal materials of soils.

Soil acidity in relation to soil type groups, in Nacogdoches County, Texas, B. H. HENDRICKSON (*Soil Sci.*, 18 (1924), No. 5, pp. 383-385, fig. 1).—In a contribution from the U. S. D. A. Bureau of Soils the results of over 200 acidity tests of various soil types occurring in Nacogdoches County, Texas, are briefly summarized. Acidity tests were made of virgin soils only and according to natural soil horizons.

It was found that the reactions of the first horizons are quite similar for the various soil groups. This condition apparently reflects the common character,

namely, the surface organic layer. Below this horizon the several groups vary one from the other in textural and structural character, and as regards aeration and internal drainage. Correspondingly the soil reaction curves for the separate groups diverge for increasing depths below the surface. Increasing acidity is invariably associated with finer textures, poorer aeration, and poorer internal drainage conditions.

Causes of variations in reaction within the soil type were found to be almost entirely traceable to discernible physical variations within the type. It further appeared that the acidity relationship depends more upon the internal drainage than upon the regional drainage. It is also considered apparent that under climatic conditions tending to produce soils well leached of calcium carbonates, it is entirely possible to estimate the mean acidity content of well-developed, well-weathered types, and to show fairly consistent differences between the acidity contents of diverse types of this character.

The vertical movement of alkali under irrigation in heavy clay soils, F. T. SHUTT and J. M. MACOUN (*Roy. Soc. Canada, Proc. and Trans.*, 3. ser., 17 (1923), Sect. III, pp. 71-74).—A continuation of previous studies is reported (*E. S. R.*, 49, p. 513). It is noted that the experimental plats have received three irrigations each season for the past eight years, and that no surface indications of alkali have been evident.

The chemical data indicate that the saline content of the first 18 in. has remained practically unchanged. It is concluded that an area of heavy clay underlaid by a heavily impregnated subsoil may be safely irrigated for a number of years, provided the irrigation is judicious and that at the outset the surface soil to a depth of 18 in. is free, or practically free, from alkali.

The "alkali" content of soils as related to crop growth, F. T. SHUTT and J. M. MACOUN (*Roy. Soc. Canada, Proc. and Trans.*, 3. ser., 17 (1923), Sect. III, pp. 75-78).—A continuation of studies begun in 1917 (*E. S. R.*, 49, p. 513) is presented covering the results obtained in the season of 1922.

It is concluded that the results of this investigation from the beginning point to 0.35 per cent of sodium sulfate, when present in the chief root feeding zone, as being the limit of tolerance for wheat. Fairly good crops of wheat have been raised on soil containing a higher saline content, but almost invariably distinct signs of distress have been evident when the amount passed 0.5 per cent. The presence of magnesium sulfate in addition complicates the question, but it is considered evident that when the alkali content approaches 1 per cent in the first 6 in. of soil the limit of tolerance for good vigorous growth has been passed.

Alkali studies.—I, Tolerance of wheat for alkali in Idaho soil, R. E. NEIDIG and H. P. MAGNUSON (*Soil Sci.*, 18 (1924), No. 6, pp. 449-467, figs. 3).—Studies conducted at the Idaho Experiment Station on the tolerance of wheat for alkali in silt loam soil are reported.

The results with the first crop showed that wheat was not affected by sodium carbonate until 0.1 per cent recoverable salt was found in the soil. At 0.2 per cent concentration there was evident toxicity, and 0.3 per cent recoverable salt always resulted in a total crop failure. Sodium chloride when present alone in the soil was not harmful to the growth of wheat until 0.2 per cent recoverable salt concentration was reached. A concentration of 0.25 per cent showed a decided toxicity.

Recoveries of 0.75 per cent sodium sulfate failed to show any detrimental effect on crop yield. The tolerance for this concentration of sodium sulfate was materially decreased by the presence of 0.07 per cent of sodium chloride. In the presence of the same amount of sodium sulfate, sodium carbonate

showed no effect until its own maximum tolerance limit of approximately 0.1 per cent was reached. In combinations of sodium carbonate and sodium chloride, small recoveries of either salt had an influence on crop yield only when the other salt concentration approached its maximum tolerance.

The results with the second crop showed that any toxic effect of the salts on plant growth was so effectively overshadowed by the stimulation of all treatments except the very highest carbonates that no measurement of toxicity could be made. However, where more crops were grown on the same soil this stimulation was overcome, and characteristic toxicities again became apparent.

The alkali soils in Hungary and their reclamation, A. A. J. DE 'SIGMOND (*Rev. in Soil Sci.*, 18 (1924), No. 5, pp. 379-381).—This is a short review of a monograph by the author on the subject.

On the nature of burn-outs, F. T. SHUTT and J. M. MACOUN (*Roy. Soc. Canada, Proc. and Trans.*, 3. ser., 17 (1923), Sect. III, pp. 79-82, fig. 1).—A continuation of previous work on the subject is noted (E. S. R., 48, p. 423).

The results of previous work are confirmed and the fact established that a burn-out is an area from which the surface soil has been removed. The subsoil is what is exposed at the bottom of a burn-out. On first breaking up these burn-outs, it has been noted that the crops are lighter on the site of the burn-outs than on the adjacent unaffected land. Cultivation for a few years brings about a uniformity of crop growth on such tracts, proving that the subsoils of the semiarid areas are fairly rich in plant nutrients and can be brought into a state of productiveness by tillage.

[Soil bacteriological studies at the Idaho Station] (*Idaho Sta. Bul.* 135 (1925), pp. 21-25).—Studies of the occurrence of *Azotobacter* in 106 samples of timbered soils of northern Idaho in which nitrification did not proceed normally indicated the presence of the organism in but 24 samples. The soils were divided into five classes, ranging from virgin timber to those cultivated for many years, and no correlation was evident between cultivation and the presence of the organism. Virgin timber soils contained the organism in a slightly greater number of cases than the cultivated soils.

Tests of 60 samples of this soil as to their ability to support the nitrogen-fixing organism showed that all supported it for a considerable period of time, and all but 14 still contained it after from 15 to 18 months.

Determinations of the H-ion concentration of each of the 106 samples by the electrometric method showed the majority of these soils to be neutral or basic, while the more common acidity tests showed all of these soils to be acid, in spite of the fact that they did not respond to applications of lime.

Tests of the influence of the leaves, needles, and bark from ash, maple, cedar, larch, white pine, yellow pine, and white and red fir on nitrogen fixation showed that in general the needles were more toxic than the sawdust from the same tree. Cedar was the most toxic, followed by the pines. These results are taken to indicate that the tree products which litter the soil are toxic to the nitrogen-fixing organism.

A study of the effect of various amounts of combinations of the carbonate, chloride, and sulfate of sodium on ammonia formation from blood, nitrate formation from ammonium sulfate, and on the growth and yield of wheat (see above) in a neutral silt loam soil showed a gradual decrease in total water-soluble salt as time progressed after their application. Sodium carbonate stimulated the ammonification of blood and the nitrification of ammonium sulfate during the period of growth of the first and second crops. Sodium chloride was toxic toward ammonification and slightly toxic toward nitrification during the first period, and slightly toxic to both processes during the second

period. Sodium sulfate was toxic toward ammonification and had little or no effect on nitrification during the first period, and was slightly toxic to both processes during the second period. The two salt combinations were toxic toward ammonification in every case in the first period, and generally stimulated nitrification. During the second period the toxicity to ammonification decreased and nitrification increased. All of the three salt combinations reduced ammonia formation during the first period, and the majority increased nitrification. These results were emphasized during the second period.

Studies on the effect of surface tension of the nutritive medium on the growth of nitrogen-fixing bacteria are also briefly reported. Soaps prepared from castor oil, palmitic acid, olive oil, and coconut oil were used as a means of depressing the surface tension of the nutritive medium. Only one case of benefit from reduced surface tension was observed.

[Soil studies at the Washington Station] (*Washington Col. Sta. Bul. 187 (1924), pp. 74-79*).—Studies by F. J. Sievers and H. F. Holtz on the maintenance of organic matter in eastern Washington soil showed that the return of organic residues to the soil has an immediate and pronounced influence on soil fertility, depending not only upon the kind of residue but more upon its nitrogen content. When the nitrogen content of the residue applied is very low crop yields are decreased because of a lack of available nitrogen, and when the nitrogen content is very high the yields are also frequently decreased because of the luxuriant vegetative growth resulting from excessive tillering.

Fertility investigations of Washington soils by Sievers and Holtz indicated that on all soils, except the mucks and sandy loams, there is very little relation between soil acidity and lime deficiency. Where legumes have failed to make proper development on many of these soils, due apparently to soil acidity, it has been found with practically no exception that the soil can be brought into an ideal condition for the growing of such legumes by the application of a phosphate fertilizer.

Studies on the effect of soil composition on the composition of the plant grown thereon showed that any practice that provides a supply of available nitrogen during a season of normal precipitation will have a pronounced effect on crop yields, whether this practice is early summer fallow tillage, the use of an intertilled crop like corn or potatoes, nitrogen fertilization, or the growth of a legume crop. Where the precipitation is abnormally low, wheat yields are no longer influenced by practices that affect the available nitrogen supply only.

It is reported by Sievers, Holtz, and H. P. Singleton that all irrigated soils in eastern Washington are well supplied in their virgin state with the mineral nutritive elements but are very deficient in nitrogen. This deficiency is so pronounced that successful crop production is impossible unless provision is made for a nitrogen supply either through fertilizers or legumes.

[Sulfur and soil organic matter studies at the Washington Station], J. R. NELLER (*Washington Col. Sta. Bul. 187 (1924), pp. 37, 38*).—It is reported that experiments on the effect of sulfur oxidation upon the rate of oxidation of soil organic matter have shown that comparatively large quantities of sulfur may be oxidized in the soils of eastern Washington without any marked retardation of organic oxidation (*E. S. R., 51, p. 122*).

Percolation studies with fine sandy loam soil showed that the addition of large quantities of sulfur caused an increase in the water-soluble potassium and calcium. An increased yield of legumes following the use of sulfur or gypsum as a fertilizer frequently resulted in an increased percentage of total protein. When large quantities of sulfur were used, the percentage of

phosphorus and potassium also increased and the percentage of calcium decreased. Top-dressing of soils previously treated with sulfur resulted in marked increases in the yield of some of the greenhouse crops.

A continuation of straw humification experiments (E. S. R., 51, p. 118) has shown that this process proceeds at a considerably faster rate when sodium nitrate or ammonium sulfate and calcium carbonate are added to the straw. Greenhouse tests have shown that merely keeping the straw moist for a few weeks previous to incorporation with the soil serves to decrease considerably the depressing effect of the straw upon the growth of wheat. This is taken to indicate that some toxic substance may be formed in the initial stages of straw decay which is later oxidized to a harmless or perhaps beneficial compound.

[Soil studies at the Irrigation Substation], H. P. SINGLETON (*Washington Col. Sta. Bul.* 187 (1924), pp. 96, 97).—It is reported that two years' results indicate that the cultivation of corn, except to control weeds, does not pay on the sandy loam soil of the Yakima Valley.

An experiment on the rate of decomposition of and nitrate production in sweet clover sod just plowed and alfalfa sod just plowed showed that the former had a 102 per cent greater rate of decomposition and a 95 per cent greater nitrogen accumulation than the latter.

Soil organic matter maintenance [at the Adams Substation], H. M. WANSER and I. M. INGHAM (*Washington Col. Sta. Bul.* 187 (1924), pp. 86, 87).—It is stated that where barnyard manure was applied to winter wheat a slight increase in yield resulted, while all other applications of organic residues or fertilizers slightly depressed the yield. When a high carbon or a low nitrogen residue was applied there was a proportionately greater depression in straw yield than where a low carbon or a high nitrogen residue was applied.

The problem of soil organic matter and nitrogen in dry-land agriculture, J. S. JONES and W. W. YATES (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 11, pp. 721-731).—Studies conducted at the Oregon Experiment Station on the maintenance of organic matter and nitrogen in soils subjected to dry-land cultivation are briefly reported.

It has been found that corn and potatoes in rotation with the small grains leave the soil enriched with organic matter. Fallow crops, rye, and field peas turned under have thus far not all increased the organic matter content of the soil over that in plats alternately cropped to winter wheat and summer fallowed. The most substantial enrichment has occurred in those plats on which corn is also included in the rotations. Field peas turned under have been found to enrich the soil with nitrogen substantially. Nitrogen has thus far been maintained on plats that have grown field peas continuously with the crops removed, but the organic matter content is lower than in plats alternately cropped with winter wheat and summer fallowed.

Soil conditions which promote nitrogen fixation, N. E. WINTERS (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 11, pp. 701-716).—Studies conducted at Cornell University on soil conditions which promote nitrogen fixation are reported.

The results showed that in Volusia soil, with a high lime requirement, and in Dunkirk soil, with a low lime requirement, 1 ton of limestone per acre promoted nitrogen fixation about as much as any heavier application. There was practically no difference between the effects on the nitrogen-fixing bacteria of equivalent amounts of calcium as limestone and as burnt lime. Dolomitic limestone gave better results than pure calcium limestone. Rapid nitrogen fixation in the soil was at first accompanied by a decrease in nitrates. Gypsum gave

no significant results in its effect on nitrogen fixation. Two tons of calcium carbonate promoted nitrogen fixation as much as 8 tons of calcium silicate.

It was found that soils may respond to the use of mineral nutrients for field crops and yet contain enough soluble minerals to supply the requirements of the nitrogen-fixing organisms. Under the conditions of the experiment, 100-lb. applications of sodium nitrate or its equivalent in ammonium sulphate or calcium nitrate stimulated nitrogen fixation, but heavy applications depressed it. These results are taken to indicate that the judicious use of nitrogenous fertilizers does not interfere with nitrogen fixation.

With the soils used, inoculation was unnecessary when conditions were made favorable for nitrogen fixation. Small quantities of aluminum chloride depressed nitrogen fixation, but iron chloride stimulated it. The quality of the organic matter added was found to be as important as the quantity, horse manure being the most valuable of any of the materials used. Composting organic materials before adding them to the soil was found to hasten nitrogen fixation during the first six weeks after application.

Nitrate studies on Purdue rotation field No. 6, I. L. BALDWIN, W. J. NICHTER, and R. O. LINDSEY (*Ind. Acad. Sci. Proc.*, 39 (1923), pp. 269-280, figs. 2).—Studies are reported which showed that, in the order named, the following rotations are effective in producing a high nitrifying power of the soil: (1) Corn, wheat, clover, and timothy, (2) corn, oats, wheat, clover, and timothy, (3) corn and wheat, and (4) corn, oats, and wheat. Soil continuously cropped to either wheat or corn showed a lower nitrifying power than soil cropped to any of the above rotations. The present crop was found to have more influence on nitrification than previous crops.

Soil improvement, [E.] J. RUSSELL (*Jour. Min. Agr. [Gt. Brit.]*, 31 (1924), No. 2, pp. 120-127, pl. 1, figs. 3).—In a contribution from the Rothamsted Experimental Station a brief summary is presented, indicating the status of soil improvement investigations at the station.

Soil management and fertilization, M. NELSON and W. H. SACHS (*Ark. Agr. Col. Ext. Circ.* 149 (1923), pp. 30, figs. 8).—Practical information on the management and maintenance of the productivity of Arkansas soils is presented.

Coniferous timber soil studies (*Idaho Sta. Bul.* 135 (1925), pp. 14, 15).—Studies on the effect of fertilizers with and without lime on coniferous timber soils are said to have shown that nitrate is the only fertilizer that materially increases crop yields. Applications of well-rotted manure did not show increased yields in any way comparable with the nitrate additions, and lime did not seem to be of material benefit. Little indication of ammonifying or nitrifying action by bacteria was evident in this soil. A resinous-like body was successfully isolated from this soil, which retarded the growth of wheat seedlings.

Mathematical expression of the influence of the fertilizing elements contained in or added to the soil [trans. title], H. LAGATU (*Assoc. Franç. Avanc. Sci. Confs., Compt. Rend.*, 46 (1922), pp. 859-866).—A brief mathematical analysis of the subject is presented.

Fertilizer instruction, D. N. PRJANISCHNIKOW (PRIANISHNIKOV), trans. by M. VON WRANGELL (*Die Düngerlehre. Berlin: Paul Parey, 1923, 5 ed., pp. XII+450 figs.* 84).—This is the fifth edition of this book.

The leaching of fertilizers from soils, A. W. R. JOACHIM (*Trop. Agr. [Ceylon]*, 63 (1924), No. 5, pp. 277-282).—In a contribution from the Department of Agriculture of Ceylon a summary of data is presented on the leaching of fertilizers from soils, special attention being drawn to the ease with which nitrates are lost by leaching, and to the fact that of all the soluble chemical

fertilizers phosphoric acid applied in the form of superphosphate is the least likely to be lost in this manner.

Fertilizer spreaders [trans. title], LEONHARDS (*Ztschr. Pflanzenernähr. u. Düngung*, 3 (1924), No. 2, *Wirtschaft.-Prakt.*, pp. 461-464).—The author summarizes work by himself and others on the comparative value of broadcast and row fertilization of crops, especially grains, by machines. The conclusion is drawn that for German conditions row fertilization by machines has no advantage over broadcast fertilization for grains, and is practically out of the question for root and other wide-row crops.

Industrial nitrogen, P. H. S. KEMPTON (London: Isaac Pitman & Sons, Ltd., 1922, pp. XII+104, figs. 19).—This is one of the Pitman Technical Primer series, edited by R. E. Neale. It deals with the principles and methods of nitrogen fixation and the industrial applications of nitrogen products in the manufacture of explosives, fertilizers, dyes, etc. It contains chapters on free and combined nitrogen and its sources, natural and artificial fixation of nitrogen, electrical fixation processes, catalytic fixation processes, fixation by combustion and explosion, industrial products of nitrogen fixation, explosives, fertilizers, dyes, other industrial nitrogen products, national nitrogen product developments, and imperial developments. A bibliography is included.

Possible potash production from Minnesota shale, H. A. SCHMITT (*Econ. Geol.*, 19 (1924), No. 1, pp. 72-83, figs. 2).—Studies conducted at the University of Minnesota are reported which showed that the Decorah shale in Minnesota is extensive and contains from 6 to 8 per cent of potash. The potash is in two states of combination, about 60 per cent being more easily available than the remainder. It was possible to obtain much potash from this shale by heat treatment with sodium salts equivalent in amount to the potash and with a slight excess of calcium carbonate. It could be rendered soluble and volatilized in part from bricks where salt and calcium carbonate were added to the raw shale.

This shale is said to be favorably situated for use with sand if a by-product from the potash extraction is suitable for sand-lime brick. It is also situated near some limestone which may be suitable for Portland cement. It has been tried without preliminary heat treatment with considerable promise of success as a fertilizer for peat soils deficient in potash.

Final report of the special committee of the Association of Official Agricultural Chemists on the availability of phosphoric acid in basic slag phosphates, H. D. HASKINS, J. A. BIZZELL, W. B. ELLETT, B. L. HARTWELL, and C. B. WILLIAMS (*Jour. Assoc. Off. Agr. Chem.*, 7 (1924), No. 3, pp. 218-252, pls. 3).—The results of studies on the availability of the phosphoric acid in basic slag phosphates conducted by the Hawaii, Illinois, Massachusetts, New Jersey, New York, North Carolina, North Dakota, Pennsylvania, Rhode Island, and Texas Experiment Stations are summarized, and data are presented on the reliability of the Wagner method of analysis for measuring the availability of the phosphoric acid in this class of products.

The results established the fact that four such slags contained their phosphoric acid in forms freely available to the crops grown, and compared favorably both in yield of crop and phosphoric acid recovered with results obtained with acid phosphate. In addition, the availability figures established by the vegetation pot work compared favorably with the available phosphoric acid as measured by the Wagner method for Thomas basic slag phosphate and the official neutral ammonium citrate method for acid phosphate or superphosphates.

Effect of iron and aluminum salts on the phosphorus recovery from soils and quartz sand treated with Tennessee rock or double acid phos-

phate, M. I. WOLKOFF (*Soil Sci.*, 18 (1924), No. 6, pp. 469-478, fig. 1).—Studies conducted at the University of Illinois on the effect of adding ferric and aluminum chlorides in modifying the phosphorus recovery from some soils and sand treated with phosphatic fertilizers are reported.

The results showed that the addition of ferric chloride to three different soils caused a decrease in phosphorus recovery when phosphorus was applied to the soil in the form of either Tennessee rock phosphate or double acid phosphate. Aluminum chloride applied to the same soils showed no depressive effect on the phosphorus recovery, but, on the contrary, in two out of three cases the phosphorus recovery was slightly increased. When either calcium carbonate, ferric chloride, or aluminum chloride was applied to fine silica flour (passing a 200-mesh sieve) treated with rock phosphate, the phosphorus recovery was not significantly affected. The application of a mixture of calcium carbonate and ferric chloride, of ferric chloride and aluminum chloride, or of calcium carbonate, ferric chloride, and aluminum chloride caused some decrease in the phosphorus recovery. The influence of applying a mixture of calcium carbonate and aluminum chloride was much smaller.

It is suggested that double salts of phosphates may be formed, which in some cases may be less soluble than the corresponding single salts. Ferric aluminum phosphate may be somewhat more insoluble than either ferric phosphate or aluminum phosphate. Structural formulas harmonizing with this hypothesis are suggested.

Repeated extractions with fresh nitric acid showed that the phosphorus from soil treated with iron goes into solution. Practically the same amount of phosphorus was extracted in five consecutive extractions whether the initial treatment was iron chloride or aluminum chloride.

Synthetic calcium silicates as a source of agricultural lime.—I, A comparison of the influence of synthetic calcium silicates with other forms of lime as affecting plant growth, R. M. BARNETTE (*Soil Sci.*, 18 (1924), No. 6, pp. 479-491).—Studies conducted at the New Jersey Experiment Stations are reported. The growth of several plants was studied in controlled pot experiments and also in field experiments to determine the influence of equivalent applications of lime in various forms on several acid soils. The studies were made with particular reference to calcium silicates as possible carriers of lime.

As a whole, the artificial calcium silicates were as effective as the common forms of lime in overcoming the unproductive condition of so-called acid soils when applied on an equivalent calcium oxide basis. The greatest deviation from this generalization occurred in the exceptional increase in the growth of barley on soils treated with dicalcium silicate. It is thought that the greater barley yields obtained with this silicate might possibly be due to the greater absorption of the silicon, resulting in a heavier and healthier plant.

The percentage of nitrogen in soy bean, barley, and buckwheat plants varied with the soil, the higher percentages being found under the more unfavorable conditions of the untreated or so-called acid soils. Treatments of limestone, calcium hydrate, and dicalcium silicate gave crops of closely comparable nitrogen content. The greatly enhanced growth on the limed soils always netted a greater recovery of nitrogen.

The rôle and importance of lime in agriculture [trans. title], M. LENGLEN (*Chim. et Indus.* [Paris], 10 (1923), No. 6, pp. 1015-1025; 11 (1924), No. 1, pp. 17-39).—This is a rather extensive review of data from various sources on the action of lime in soil, with special reference to its influence on the physical and chemical characteristics of the soil and on the growth and yield of crops.

Making limestone more available for farmers, G. ROBERTS (*Ky. Agr. Col. Ext. Circ. 174* (1924), pp. 17, figs. 5).—Practical information on the burning of limestone is presented, together with plans and specifications for building and burning a limekiln and plans and specifications for a lime shed.

Some questions in the oxidation of elementary sulfur [trans. title], A. RIPPEL (*Centbl. Bakt. [etc.]*, 2. Abt., 62 (1924), No. 13-16, pp. 290-295).—Studies are briefly reported, the results of which are taken to indicate that the oxidation of elementary sulfur in soil is almost exclusively of a biological nature. Apparently an entire series of aerobic microorganisms participate which are not generally thought of as sulfur bacteria, and most aerobic organisms are thought to possess such power under certain favorable conditions.

Fertilization with gas house waste [trans. title], D. M. KÜTZING (*Wasser u. Gas*, 13 (1923), No. 33-34, pp. 796, 797).—The results of six different experiments on the fertilizing value of the waste water from gas houses on meadow and beet crops, when applied as a top-dressing or incorporated in the soil, are briefly summarized.

The use of waste water as a top-dressing injured vegetation, due to the caustic action of the free ammonia and the toxic action of other constituents. Such injury was small during rainy weather or where the gas water was diluted. The injury disappeared after some weeks and was more than compensated for by the increased plant development due to the action of the nitrogen content of the gas water. The increase depended upon the extent of the previous injury and the volatility of the ammonia.

When incorporated in the soil gas water gave results approximating those given by ammonium sulfate, the best results being obtained when the gas water was applied during damp, cool weather. Measures used for the prevention of nitrogen losses from concentrated liquid manure were profitably applied to gas water.

Commercial fertilizers (*Kans. State Bd. Agr. [Quart.] Rpt.*, 43 (1924), No. 170, pp. 43).—Information about commercial fertilizers in Kansas is presented, together with rules and regulations concerning their registration and sale and lists of dealers and of fertilizers registered July 1, 1924. In addition, guaranties and the results of actual analyses of 60 samples of fertilizers and fertilizer materials collected for inspection in the State during the fall of 1923 and spring of 1924 are presented.

Changes in the composition and cost of fertilizers in New York from 1914 to 1924, L. L. VAN SLYKE (*New York State Sta. Bul.* 525 (1924), pp. 3-19).—This general review of conditions relating to commercial fertilizers before, during, and after the war indicates that normal conditions are gradually returning in respect to the kinds of materials offered for sale, the composition of fertilizer mixtures, and the cost of plant nutrient constituents. One outstanding fact is that mixed commercial fertilizers contain, at the present time, a larger average percentage of plant nutrients than ever before.

AGRICULTURAL BOTANY

The physiology of photosynthesis, J. C. BOSE (*London, New York, and Calcutta: Longmans, Green & Co.*, 1924, pp. XX+287, figs. 60).—This record of quantitative research regarding various phases of photosynthesis involves the relative numerical efficiency of light waves of varying length and energy and the effects of temperature change or of carbon dioxide variation on the activity of photosynthesis. The experiments have been carried out by means of a variety of sensitive apparatus especially designed for the different objects in view, including the use of automatic recorders.

The various chapters deal, respectively, with methods; the evolution of pure oxygen under light; determination of rate of evolution of equal volumes of oxygen; the automatic record of the rate of evolution of oxygen; photosynthesis under increasing intensity of light; relation between the quality of light and the amount of photosynthesis; the physiological factor in photosynthesis; change in photosynthetic activity under stimulus, anaesthetics, and poisons; effect of infinitesimal traces of chemical substances on photosynthesis; the electric response to light; phenomenon of photosynthetic induction; effect of intermittent light on photosynthesis; the automatic radiograph; the electric photometer; relation between CO_2 supply and photosynthesis; photosynthetic evolution of oxygen in the complete absence of carbon dioxide; effect of variation of temperature on photosynthesis; the tonic factor in photosynthesis; the daily variation in photosynthetic activity; determination of the photosynthetic efficiency of light of different colors; determination of the energy of the different rays in the solar spectrum; determination of photosynthetic efficiency of the spectral rays; determination of the increase of weight due to photosynthesis; simultaneous determination of carbohydrate-formation by two independent methods; efficiency of the photosynthetic organ in storage of solar energy; the physiological scale and the law of photosynthesis for the different factors; and photosynthesis under simultaneous variation of different factors, with, finally, a general review presenting salient features.

Effect of infinitesimal traces of chemical substances on photosynthesis. J. C. BOSE (*Nature* [London], 112 (1923), No. 2803, pp. 95, 96, fig. 1).—The possibility of ultrameasurable traces of chemical substances affecting assimilation is considered as capable of being effectively investigated through the very sensitive process of carbon assimilation by water plants. The usual method of counting oxygen bubbles given out by such plants under illumination is, however, regarded as untrustworthy for purposes of exact quantitative determination, owing to the spontaneous variation in the size and frequency of the bubbles. This difficulty has now, it is claimed, been completely overcome by a new automatic device showing the normal rate of photosynthesis, as well as its induced variations, and described in full in the work noted above.

Application of a nitric acid solution 1:100,000,000,000 induced no change in photosynthesis by the aquatic plant *Hydrilla verticillata*, but 1:10,000,000,000 increased the rate by 100 per cent, and 1:2,000,000,000 "caused a further increase of nearly 200 per cent." This, however, was the climax. The enhanced activity underwent a slight decline at dilutions of from 1:1,000,000,000 to 1:100,000,000, though the activity was still 100 per cent greater than the normal. There was an abrupt depression of activity at lower dilutions than 1:1,000,000.

Other facts cited include the effects at low concentrations of certain other substances on carbon assimilation. Among these is formaldehyde, which, according to Baeyer's theory, is one of the first products from which carbohydrates are formed by polymerization. An objection to this theory has been that formaldehyde is extremely poisonous to plants, but the present author found that formaldehyde at 1:1,000,000,000 increased photosynthesis by 85 per cent, though in higher concentrations it produced its normal poisonous effect. Since the intermediate stages of transformation of formaldehyde to carbohydrate are likely to be rapid, no accumulation of formaldehyde to a poisonous degree would be likely to occur. Thus the difficulty in accepting Baeyer's theory may be removed.

Nutrient and toxic effects of certain ions on citrus and walnut trees, with especial reference to the concentration and P_H of the medium. H. S.

REED and A. R. C. HAAS (*California Sta. Tech. Paper 17* (1924), pp. 75, pls. 2, figs. 29).—The authors give the results of an investigation on the effects of certain factors on the growth and composition of walnut and citrus trees, the work having an important bearing on orchard practices in semiarid regions. Seedlings were grown in water and sand cultures which received balanced nutrient solutions to which there were added varying proportions of a number of compounds.

Walnut seedlings were found to absorb sulfate in increased amounts when the concentration of that ion in the culture solution was increased, although absorption did not run parallel with concentration.

Concentrations of nitrate as high as 1,600 parts per million, furnished as sodium nitrate, had no detrimental effect on the growth of walnut seedlings, and higher concentrations had a retarding influence only on the growth of the tops.

Walnut and orange seedlings absorbed chlorine readily, and their growth was characteristically affected by amounts which were harmless in the case of other anions. Young orange trees grown in soil cultures were seriously injured by the application of irrigation water containing 880 parts per million of chlorine (1,500 parts per million of sodium chloride).

A concentration of 1,000 parts per million of sodium bicarbonate was found to restrict the growth of walnut roots and often prevented the development of the epicotyls.

The injurious effect of high concentrations of potassium ions were not evident until after a considerable time had passed. Walnut seedlings in culture solutions containing 1,700 parts per million of potassium made good growth for a time, but eventually the foliage turned yellow and the roots ceased to grow. Young orange trees in sand cultures exhibited a somewhat similar character when they received solutions containing 500 parts per million of potassium. The leaves ultimately present a characteristic mottled appearance.

From the authors' experiments it is concluded that sodium is not severely toxic unless the concentration is fairly high.

Walnut seedlings made thrifty growth in solutions of calcium chloride but were very restricted in their growth in equimolecular solutions of sodium chloride. Strong concentrations of chlorine as calcium chloride were somewhat less toxic to rough lemon seedlings than equivalent concentrations as sodium chloride. Where calcium was furnished in subminimal amounts the roots of the young orange trees died and the foliage was chlorotic. The ash of the trunk and main roots of citrus trees was found richer in calcium than that from other parts of the tree, though in some cases the older leaves were very rich in that element. Data were secured which indicate that the absorption of calcium and potassium presents a sort of antithesis in the function of the citrus tree. If one element is high in the ash, the other will be low. The roots of walnut seedlings were extremely sensitive and quickly injured in calcium-free solutions.

Culture solutions which were on the alkaline side of the neutral point were not detrimental to the growth of rough lemon seedlings; in fact, they made more growth at pH 8 than at pH 6 or lower. Citrus and walnut seedlings grown at pH values of 7 or higher contained as much chlorine in the ash of their tops as those grown at lower pH values. The pH values of the sap expressed from walnut seedlings were quite uniform regardless of the reaction of the solution in which they were grown.

A concentration of 1,500 parts per million of sodium sulfate caused no apparent injury to walnut seedlings, but at a concentration of from 3,000 to 6,000 parts per million the growth of the seedlings was progressively retarded. Increasing concentrations of sodium nitrate had a somewhat similar effect.

A low concentration of magnesium on orange trees was mainly evident in a peculiar type of chlorosis along the midribs of the leaves. Aside from this, no profound physiological disturbances were observed.

The authors claim that, while it is difficult to anticipate the effects of a given concentration of an ion in the culture solution upon the amount of that ion found in the plant, in a general way the percentage found in the plant reflects the concentration in the culture solution.

The effects of sodium chloride on trees growing in soils under controlled conditions are said to throw some light upon certain conditions often seen in the field. The restricted growth of roots and shoots and the premature abscission of leaves agreed with analyses which showed an increased chlorine content of those members.

A study of the June drop of fruits in Delaware, L. R. DETJEN (*Delaware Sta. Bul. 139* (1925), pp. 19-21).—A report is given of a large amount of material studied for the development of the embryo as affected by various climatic and other conditions. Some of the drop of fruits was attributed to frost injury or lack of fertilization, which resulted in the failure of the embryo to develop. The data collected on the physiological drop of fruits are said to indicate that rain and heavy dew cause the abscission of fruits more readily than dry weather conditions. Fruits fell more readily when trees were jarred in the morning hours than in the late afternoon, probably because of the greater turgidity of cells. Wind was not a direct factor in causing physiological drop, nor were daily differences in temperature considered responsible for it. Studies of the fluctuation in soil temperature, evaporation of water, and atmospheric moisture are believed to indicate that these are not direct factors in the dropping of fruits.

Some orchard conditions affected by arsenicals, marls, and other factors, W. P. HEADDEN (*Colorado Sta. Bul. 294* (1924), pp. 3-31, figs. 10).—Attention is called to the dying of orchard trees in parts of Colorado and elsewhere that is considered due to soil conditions. Several explanations are offered as to the immediate causes, and remedial suggestions are given.

In some cases the death of the trees is attributed to the corrosive effect of arsenicals used for controlling insect pests. The substitution of lead arsenate for the older arsenicals has done away with this form of injury, but the prolonged and heavy use of lead arsenate is considered to become injurious through the action of sodium compounds in the soil making the arsenic soluble and capable of absorption by the tree roots. Another factor which is detrimental to orchards is said to be the accumulation of injurious quantities of nitrates in the soil. Marl soils are also considered unfavorable.

The author suggests the avoidance of the causes of injury as far as possible and the growing and plowing under of cover crops in orchards.

[Report of] division of bacteriology, S. C. VANDECAVEYE (*Washington Col. Sta. Bul. 187* (1924), p. 35).—Among investigations in progress, the author carried on a study of the value of certain stains for isolating legume bacteria. Most of the organisms associated with legume bacteria were easily eliminated, but *Bacterium radiobacter* appeared more resistant. Pure cultures of the organism, however, were killed in less time in a less concentrated solution than pure cultures of the legume bacteria, and this is believed to indicate that *B. radiobacter* can be eliminated from the legume bacteria.

GENETICS

Genetics and eugenics, W. E. CASTLE (Cambridge: Harvard Univ. Press; London: Humphrey Milford, 1924, [3. ed., rev. and enl.], pp. VIII+434, pls. 60,

figs. 41).—This is a revised and enlarged edition of the book previously noted (E. S. R., 47, p. 67). The first portion of the new book deals with the biological basis of genetics, thus giving a better introduction to the essential facts relating to the material basis of heredity and the cytological evidence. Three other new chapters are included dealing with the principles of plant breeding, the principles of livestock improvement, and the relation of Mendelism to mutation and evolution. The newer developments in genetics have necessitated rewriting certain of the other chapters, especially those connected with linkage and crossing-over. The translation of Mendel's paper has been omitted.

The founders of the art of plant breeding, F. C. WERKENTHIN (*Iowa Acad. Sci. Proc.*, 29 (1922), pp. 291-310).—This posthumous paper is published with an introduction by L. H. Pammel.

Plant breeding in the subtropical, semi-arid regions of Arizona [trans. title], J. C. T. UPHOF (*Ztschr. Pflanzenzücht.*, 10 (1924), No. 1, pp. 9-23, *figs. 5*).—The methods and results in breeding work carried on by the Arizona Experiment Station with alfalfa, wheat, sweet corn, tepary beans, and sorghum are reviewed.

A preliminary statement of the results of Mr. Houwink's experiments concerning the origin of some domestic animals.—Part V, Conclusion, J. P. LOTSY and K. KUIPER (*Genetica [The Hague]*, 6 (1924), No. 2-3, pp. 221-277, *pls. 8*).—This is the concluding paper of this series (E. S. R., 51, p. 228), in which further accounts are given of various crosses between species of the genus *Gallus*.

It was found that the individuals called *bankantam*, which are the birds which Houwink thought to be pure *bankiva*s, were usually dominant in most characteristics in the crosses. The crossbred individuals were in most cases more or less fertile. It is suggested, however, that the appearance of the duckwing pattern in some of the F_2 s of the *bankantam* \times *G. sonnerati* must be from *sonnerati* birds, in which the silver factor (*S*) responsible for this pattern is inhibited by another factor called *I*.

In conclusion, the authors believe that their evidence indicates that *G. bankiva* is not the sole ancestor of our domestic poultry. The introduction of the silver factor from the *sonnerati* and the introduction of a factor for black from *G. varius* are offered as evidence, and it is believed that all known wild species of fowls have taken some part in the formation of our domestic poultry.

In a discussion as to the lack of the influence of the species other than *bankiva*, it is noted that this species is found in nature in a greater number of localities, thus indicating a greater adaptability and hardiness and suggesting the part which natural selection may have played.

An introduction to cytology with special reference to the cotton plant, H. J. DENHAM (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 3 (1924), No. 19, pp. 217-226, *figs. 2*).—The meaning and purpose of cytology are explained under the topics of cell structure, cell division, chromosome number, and the cytology of the cotton plant. An ample glossary is appended.

The cytology of the cotton plant, I, II, H. J. DENHAM (*Brit. Cotton Indus. Research Assoc., Shirley Inst. Mem.*, 3 (1924), Nos. 20, pp. 227-248, *pls. 8*; 21, pp. 249-252, *pl. 1*).—Research carried out at Shirley Institute on the cytology of the cotton plant is reported on in the following papers:

I. Microspore formation in Sea Island cotton.—The cytology of pollen formation in Sea Island cotton (*Gossypium barbadense*) is briefly described, with special reference to the reduction division of the pollen mother cell and chromo-

some number. The reduction division takes place along normal telosynaptic lines, and on the whole agrees with the process as described by Cannon¹ in hybrid cotton plants. Of particular interest are the perinuclear zone, which seems to be largely concerned with spindle formation in both homotype and heterotype divisions, but not in the premeiotic or somatic divisions; the manner in which the chromosomes are brought to the center of the nucleus in diakinesis; and the method of tetrad division by furrowing. The chromosome number is 26, with two chromosomes distinctly larger than the others. Thread ring structures described in parallel material have not been found in well-fixed buds, but ring figures of a similar appearance occur in cells which show distortion by the fixative.

II. *Chromosome numbers of Old and New World cottons.*—Counts of the chromosome numbers in 32 varieties of cotton, including American, Sea Island, Egyptian, Indian, and Chinese types, and American grown in India showed these numbers to fall into groups of 26 and of 13 chromosomes. The cottons of the New World and Egypt were characterized by 26 chromosomes and those of Asia by 13. This may, perhaps, explain the impossibility of crossing American or Egyptian cottons with Indian types, and is thought to suggest a possible solution of the difficulty with the help of cytology.

The reduction division in some wheat species [trans. title], W. DE MOL (*Genetica* [*The Hague*], 6 (1924), No. 4, pp. 289–336, figs. 57).—A study of the reduction division in a number of species of wheat showed the pollen mother cells in the young anthers to lie close together and in the later stages to form a ring, when seen in transverse sections. The first division stage, a contraction of the chromatic substance in the nucleus, is followed by the leptoneuma stage, synapsis, zygonema, a third contraction stage, strepsinema and diakinesis.

After diakinesis a fourth contraction was observed. The wall of the nucleus then disappears, and soon afterwards the gemini are seen in the cytoplasm. The multipolar spindle is then formed, and is followed by a bipolar spindle. In the bipolar spindle the bivalent chromosomes are scattered through the whole of the spindle figure, but in the later stages they are so arranged that they form the equatorial plate. Both this stage and the anaphase are favorable to the counting of the number of chromosomes. The anaphase and telophase of the first division take place in the usual way.

In the next stage, the interkinesis, the chromatic substance clings to the wall of the nucleus. After interkinesis another (fifth) contraction similar to the one following diakinesis was observed. The chromatic substance is scattered over the bipolar spindle, as described in the case of the heterotype division. In the metaphase of the homotype division, the number of chromosomes could not be determined. The anaphase, telophase, and the formation of the pollen tetrads are said to proceed normally. In the tetrads as well as in young pollen grains a radiation of the cytoplasm could be seen around the nucleus.

The cultivated species of wheat may be grouped as follows according to their chromosome numbers: *Triticum monococcum* with 7 chromosomes; *T. dicoccum*, *T. turgidum*, *T. durum*, and *T. polonicum* with 14 chromosomes; and *T. vulgare*, *T. compactum*, and *T. spelta* with 21 chromosomes. This division is held to correspond roughly to that based on different degrees of sterility, on serological behavior, and on susceptibility to certain diseases.

Investigations on the genetics of geographical variation, I [trans. title], R. GOLDSCHMIDT, J. SEILER, and H. POPPELBAUM (*Arch. Mikros. Anat. u.*

¹ Cannon, W. A. *Studies in Plant Hybrids: The Spermatogenesis of Hybrid Cotton*. Bul. Torrey Bot. Club, 30 (1903), pp. 133–172.

Entwickl. Mech., 101 (1924), No. 1-3, pp. 92-337, figs. [162]).—This is the first paper of a series dealing with the inheritance of variations in the caterpillars of strains of gipsy moths found in different sections of the world. A statistical study has been made of the inheritance of various characters in crosses between 12 strains of the genus *Lymantria* native to Europe, Japan, and Massachusetts. Certain of the experimental work was done in each of the places mentioned.

Mottling of soybeans, C. M. WOODWORTH and L. J. COLE (*Jour. Heredity*, 15 (1924), No. 8, pp. 349-354, figs. 2).—The authors discuss their experience with mottling in soy beans and conjectural causes of its occurrence.

Study of some correlations in the peanut [trans. title], G. NEVANO (*Staz. Sper. Agr. Ital.*, 57 (1924), No. 1-3, pp. 17-32).—In studies with a type of peanut cultivated in the Provinces of Naples and Salerno the author found the coefficient of correlation between the weight of dry pods and their total number to be 0.874 ± 0.007 ; between the weight of dry pods and their average unit weight, 0.384 ± 0.026 ; between weight of dry pods and number of peas to the pod, 0.218 ± 0.029 ; between weight of dry pods and of plants with pods attached at the time of lifting, 0.794 ± 0.011 ; and between weight of dry pods and of plants without pods at time of lifting, 0.610 ± 0.019 . The best method of improving the peanut is concluded to be that of selecting plants bearing the most seed pods without considering their weight or size and number of peas.

The Pratt family: A record of human inbreeding for eight generations, F. B. HANSON (*Jour. Heredity*, 15 (1924), No. 5, pp. 207-210, fig. 1).—An account is given of eight generations of a pedigree of a girl from a well-known family of St. Louis, Mo. The existence of considerable inbreeding in this pedigree is noted, with a discussion of the probable amounts of inbreeding that would be found in ordinary populations if sufficient numbers of the ancestors were known.

Some varieties of white rabbits, W. E. CASTLE (*Jour. Heredity*, 15 (1924), No. 5, pp. 211-219, figs. 9).—The genetic factors involved in the production of albino, Himalayan albino, yellow chinchilla (white with gray eyes), Vienna, Dutch, spotted English, and French silver rabbits are briefly reviewed, with reference to other color factors.

Inheritance studies and crop breeding, E. F. GAINES (*Washington Col. Sta. Bul.* 187 (1924), pp. 54, 55).—In crosses between varieties of club and common wheat occurred longer clubs than the average of the club parent and common types shorter than the common parent, variations breeding true in later generations. Horny endosperm was inherited as a single Mendelian unit in 20 different crosses. Yellow berry was inherited independently of true horny or starchiness and was controlled by two factors in certain crosses and three in others. Immunity from bunt in Hussar and a strain of White Odessa was dominant in inheritance, whereas the resistance of other wheats tested during recent years behaved as a recessive, multiple factors always being necessary to explain the results.

In crosses between Red Rustproof and hull-less, as well as common oat varieties, time of ripening, glume color, red lemma color, hull-lessness, awning of the secondary oat, rachis length, and resistance to covered smut segregated in F_2 in response to the combined reaction of triple allelomorphs in each case. Black glume color was inherited as a simple dominant. Since certain wild oats have 7 chromosomes, others 14, and the cultivated oats of these experiments 21, it is suggested that the three factors producing a single effect may have a phylogenetic significance in many cases.

On human albinism [trans. title], H. ZIMMERMANN (*Arch. Rassen u. Gesell. Biol.*, 15 (1923), No. 2, pp. 113-136, figs. 6).—Several pedigrees are given which

include individuals showing complete or partial albinism. Total albinism was found to be inherited as a simple Mendelian recessive character, while the mode of inheritance of partial albinism was not so clear.

Studies on the physiology of reproduction.—I, The flocculation of sperm suspensions in relation to surface charge, A. WALTON (*Brit. Jour. Expt. Biol.*, 2 (1924), No. 1, pp. 13-20, fig. 1).—In physiological studies of the activity of spermatozoa of *Echinus esculentus* and *E. miliaris* at the Animal Breeding Research Department, Edinburgh, and the laboratory of the Marine Biological Association, Plymouth, the effect of solutions having pH values varying from 1 to 10 on the velocity of the movements and flocculation of the sperms was determined.

The velocity of the sperms was observed microscopically in a specially constructed glass cell through which an electric current was passed, and the rate of movement toward the cathode was estimated in microns per second by the use of a stop watch. Although several factors interfered with the detailed results, it was found that in extremely acid solutions pH 1 to 2, the charge of the sperms was positive, but as the pH increased the charge fell to 0 at about pH 3, with a negative charge increasing as the pH increased to from 7 to 8, followed by a fall in more alkaline solutions.

In the flocculation study series of solutions having pH values ranging from 1 to 10 were prepared in test tubes from m cane sugar, sea water, and egg water. Both microscopic and macroscopic determinations of the flocculation were made after slowly shaking the tubes on a rotary shaker. Agglutination was most intense at pH 3, while the sperms were completely dispersed from pH 5.2 to 8.5. The activity increased with H-ion concentration within this range, but the sperms became agglutinated at about pH 8.8. When flocculation occurred in acid solutions, the heads of the sperms were found to adhere, while in agglutination due to alkaline solutions the tails fused parallel and became twisted with the movement of the heads.

The author states that sea water decreases the stability of the suspension, with a greater decrease occurring in egg water. It is noted that a close relation apparently exists between the effect of the H-ion concentration on the velocity and its effect on the agglutination. In general the study indicates that agglutinating substances are those which are expected to reduce the charge of sperms or alternatively increase the velocity of collision.

Fertility in mice, A. S. PARKES (*Brit. Jour. Expt. Biol.*, 2 (1924), No. 1, pp. 21-31, figs. 2).—The average size of litters in 1,795 mice born under the author's observation was 6.72, with a standard deviation of 2.5. Of these, 52.1 per cent were born in litters of 6, 7, or 8.

In investigating the effect of various factors on litter size, it was found in 13 pregnant females, killed and dissected, that the total number from each cornu of the uterus was practically the same, though the equal distribution was not always followed in each individual. The average size of litters born during the different months of the years varied from a minimum in March of 5.0 to a maximum of 7.6 in July. When grouped according to 3-month periods the litter sizes were January to March 6.03, April to June 6.40, July to September 7.12, and October to December 6.45. The first litters of females averaged 6.2, the second litters 7.6, and the third litters 6.3, with 6.2 as the average size of litters after the third. The average size of litters in which the pregnancy was initiated immediately after parturition and thus carried during lactation was 6.4. Polygynous matings likewise had little effect on litter size, the average being 6.5.

In discussing the results, the author notes that 9.8 per cent of the ova produced (determined by the corpora lutea counts) by the females dissected were not accounted for as fetuses. It is suggested that the increased litter size in the summer months may be due to a temperature relation, since albino mice kept under unheated conditions did not breed during the winter. When a constant temperature was maintained, however, they bred throughout the winter with very little change in the normal litter size.

The functional ability of transplanted ovaries in rats [trans. title], B. P. WIESNER (*Arch. Mikros. Anat. u. Entwickl. Mech.*, 99 (1923), No. 1, pp. 140-149, pl. 1).—The author has made transplantations of ovaries into the uterus of female rats and young have been successfully produced at the Academy of Science at Vienna. In three cases colored young were produced from matings of albino males with albino females having ovaries transplanted from colored individuals. No evidence was found of any influence of the foster mother on the development or color of the young, but the number of young produced by mothers having transplanted ovaries was much reduced. There were also found to be decreased numbers of follicles in transplanted ovaries, and smaller numbers of ova were matured.

FIELD CROPS

Some misapplications and limitations in using Student's method to interpret field experiments, S. C. SALMON (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 11, pp. 717-721).—Attention is called to some limitations in the use of Student's method which must be considered if errors and misapplications are to be avoided.

Handbook of breeding of agricultural plants, C. FRUWIRTH (*Handbuch der Landwirtschaftlichen Pflanzenzüchtung*. Berlin: Paul Parey, 1924, vol. 3, 5 ed., rev., pp. XVI+245, figs. 46).—A further revision of the volume (E. S. R., 47, p. 823) dealing with the breeding of potatoes, Jerusalem artichokes, flax, hemp, tobacco, hops, buckwheat, and legumes.

Experiments with cereals at the Akron (Colo.) Field Station in the 15-year period, 1908 to 1922, inclusive, F. A. COFFMAN (*U. S. Dept. Agr. Bul.* 1287 (1925), pp. 63, figs. 29).—Varietal and seeding experiments with cereals, supplementing those noted earlier (E. S. R., 36, p. 33), are reviewed with descriptions of the soil, climate, and crops of the Akron district and discussion of the choice of crops and recommended types of farming. Meteorological data are included.

Varieties appearing to be best adapted and recommended for this district include Kanred and Turkey winter wheat; Peliss, Arnautka, Akrona, and Converse (Red Russian) spring wheat; Coast and Smyrna barley; Kherson, Albion, and Colburn oats; Red Turghai proso; Manchu Brown kaoliang and selections of Dawn kafir; and Akron White, Fulton Yellow, Minnesota No. 13, and White Cap corn. Early seeding is generally advised, with acre rates of from 3 to 5 pk. for winter and spring wheat, 4 pk. for oats and for barley, and from 15 to 20 lbs. for proso. Spring rye, winter and spring emmer, spelt, flax, buckwheat, and most of the grain sorghums are considered of doubtful value in this district.

Crop rotation and cultural methods at the Akron (Colorado) Field Station in the 15-year period from 1909 to 1923, inclusive, J. F. BRANDON (*U. S. Dept. Agr. Bul.* 1304 (1925), pp. 28, figs. 9).—The annual and average yields of winter and spring wheat, oats, barley, and corn in different crop sequences and under different cultural methods during the period indicated are reported on, with descriptions of environmental and climatic conditions in the

vicinity of the station and meteorological observations. The merits of the crops mentioned, kafir, milo, Sudan grass, alfalfa, sweet clover, brome grass, winter rye, and potatoes, are related, and methods are outlined for handling fallow, green manures, and crops on prairie sod, and for the control of soil blowing.

Winter wheat is one of the best adapted and generally most profitable crops for the region and responds the best to cultural methods. Its acre yield on fallow has averaged 19.1 bu., on disked corn land 13.5 bu., and on land continuously cropped to wheat and deep fall plowed 10.5 bu. Although it does not respond as well to fallow, spring wheat after either corn or small grain averages about the same as winter wheat. Barley, oats for grain and hay, and corn and sorghums for forage and silage are also valuable crops.

Spring plowing small grain stubble had an advantage over fall plowing during a series of years. Subsoiling, deep tilling, green manures, and sod crops were either unprofitable or were followed by reduced yields.

According to the data cited, the most stable type of agriculture for this region will be diversification, depending mainly on livestock and emphasizing the cash grain crops less. Corn in rotation with small grain would be especially valuable in such systems. More extensive grain production would be based upon winter wheat and a liberal use of fallow.

Drill calibration and its relation to stand and yield of small grains, H. W. HULBERT (*Jour. Amer. Soc. Agron.*, 17 (1925), No. 2, p. 92).—Seeding rates varying from 4 to 12 pk., depending upon the size of seed of the variety, were required to place equal numbers of seeds of different varieties of peas on a unit area at the Idaho Experiment Station. The number of seed delivered to a unit area with different varieties of wheat and oats also varied considerably, while less variation occurred in barley varieties. See also an earlier note (E. S. R., 50, p. 230).

High or low speeds had little effect upon the amount of seed delivered, although a slight decrease was seen at the higher rates of speed. The amount of seed delivered was not affected by the amount of seed in the hopper. The size of seed of the different varieties must be considered carefully if accurate results are to be obtained in variety tests with field peas. The lesser variation in the size of the seed of small grain varieties would probably minimize the importance of such consideration.

[Field crops experiments in Idaho, 1924] (*Idaho Sta. Bul.* 135 (1925), pp. 17-19, 33, 44, 49-53).—Agronomic investigations (E. S. R., 51, p. 829) at the station and substations included variety tests with winter and spring wheat, oats, barley, grasses, potatoes, field peas, vetch, red clover, and miscellaneous legumes; nursery trials with cereals; seeding tests with winter and spring wheat, oats, sunflowers, and potatoes; and studies of weed control.

Idaho-grown red clover was superior to other domestic and to exotic strains. Sweet clover was desirable as a drought resistant pasture crop for nonirrigated conditions and made ample hay yields. Sunflowers were a poor crop to precede fall-sown wheat, probably because they remove much plant food and moisture from the soil. Seeding flax in combination with wheat gave unsatisfactory results.

Cultivation seemed to be the cheapest and most effective means of eradicating wild morning-glory. Carbon disulfide properly applied will eradicate this weed, but the treatment is too expensive except for small areas.

Experiments with potato varieties demonstrated that yields can be consistently maintained by introducing new seed. May plantings produced the highest yields, but the tubers from June plantings were smoother and truer

to type. Seasonal conditions did not favor production of tubers true to type in the Palouse and other nonirrigated sections where certified seed potatoes are grown. Yield rose at the High Altitude Substation as the size of seed was increased up to the half potato, or 4-oz. seed piece.

Winter wheat on summer fallow at the High Altitude Substation produced twice as much grain as after wheat on late fall plowed land. Wheat stubbled in yielded less than half that on late fall plowed land planted the same date. Fallow receiving the better cultivation responded with increased wheat yields.

[**Field crops experiments in Washington**], O. E. BARBEE, E. G. SCHAFER, O. M. MORRIS, H. M. WANSEER, C. E. HILL, H. P. SINGLETON, and C. C. WRIGHT (*Washington Col. Sta. Bul.* 187 (1924), pp. 52, 53, 55, 56, 64, 82-86, 88-92, 94-96, 98, 99, 100, 102-104).—Supplementing previous work (E. S. R., 51, p. 136), these pages report varietal trials with winter and spring wheat, oats, barley, rye, corn, soy beans, field peas, Lima beans, millet, sorgo, grain sorghums, alfalfa, and miscellaneous forage crops; breeding work with potatoes; seeding and cultural trials; and rotations carried on at the station or substations. The merits of certain important varieties are pointed out.

Yields of wheat following corn and sunflowers differed very little on rich soils, whereas on less fertile hill slopes the wheat yield after sunflowers was markedly reduced. More sunflower seed per acre was obtained from plants 12 in. apart in 36-in. rows than from thicker or thinner spacings. In the 2-year rotation of wheat and peas, winter wheat slightly outyielded spring wheat. In 2-year rotations winter wheat following corn, peas, and summer fallow produced 28.6, 34.7, and 42.9 bu., respectively. Similar differences in winter wheat yields occurred when the rotation was extended to 3 years and spring wheat included.

No consistent differences in type of material produced was found in the crop from various forms of seed tubers. Abnormal forms seem to result from growing conditions, and, as seed, have slight influence over the shape of tubers in the following crop.

According to preliminary studies at the Adams Substation of factors responsible for periodicity of growth of the wheat plant, delay in seeding, the nearest approach to a delay of season possible without controlled conditions, may produce a shift in the relative fruiting dates of different varieties. The optimum of light and temperature varied for different varieties, and delayed seeding shifted the growth period of the plant into an equilibrium of conditions appearing more favorable for some varieties and less favorable for others. Under semicontrolled greenhouse conditions one variety fruited in nearly the same number of days with a daily light exposure of any interval between 4 and 24 hours. Some relationship seemed to exist between the fruiting characteristics and possibilities of a variety and the climatic conditions under which it was developed. Because of its use of and need for moisture, Hybrid 128 could not be considered as drought resistant as Turkey wheat.

Contrary to results in similar experiments at Lind, Wash., and Moro, Oreg., (E. S. R., 49, p. 828), winter wheat yields at Waterville on fall plowed land have equaled or exceeded those on spring plowing. Fall plowing enough land so that the balance may be completed early in the spring is recommended as a practice saving labor and equipment and conserving soil moisture. Shallow cultivation during spring and summer of the fallow year followed by plowing in October after the rains, the land being left rough until spring seeding, has given best results with spring wheat.

Cutting experiments at the Irrigation Substation showed that alfalfa allowed to become fairly mature will produce larger yields than when cut immature,

even though an extra cutting is obtained. Cultivating corn, except to control weeds, does not seem to pay on the sandy loam soil of the Yakima Valley. The methods and current yields in a duty-of-water experiment with alfalfa and in a study of late fall irrigation of alfalfa and corn are set forth.

[Agronomic] work done under the economic botanist for the year **1922-23**, W. BURNS (*Bombay Dept. Agr. Ann. Rpt.*, 1922-23, pp. 151-159).—Several of the canal weeds were found to have peculiar organs which enable the weeds to pass through dry seasons buried in mud. Such organs seem to be formed only when the drying is gradual. *Potamogeton perfoliatus*, the worst canal weed, grew better on silt substratum than on gravel. A constant level in the canal favored weed growth more than did a fluctuating discharge.

Studies on the life history of *Cyperus rotundus* (E. S. R., 50, p. 238) showed that although seeds are not the principal means of reproduction and only a small percentage succeed in developing into plants, the total seed production in infested fields is so great that seed formation must be prevented by cultivation. Experiments with the tubers gave indications that a combination of plowing and exposure in the hot weather with a cover of rubbish or a smother crop will rid a field of the pest, especially when followed by continued cultivation.

Injection of a solution of sodium arsenite into the stem quickly killed lantana. Analysis of the roots and branch tips showed that the poison had penetrated throughout the plant.

Pearl millet (bajri) was found to be in a very hybrid condition. Progeny of plants selected for apparent drought resistance could be grouped as to plants entirely hairless, those with hairs only at the base of the leaves, and those hairy all over the sheath, base, and leaves. Correlation studies showed that the hairless are generally larger plants with a lower death rate and higher yield, and that as hairiness increases size and yield decrease and the death rate increases. However, certain individuals characterized by both hairiness and high yields were seen.

The improvement of grazing areas (E. S. R., 51, p. 34), work with pure lines of safflower, seeding tests with pearl millet, and varietal and storage trials with potatoes are described briefly.

Simple contrivances for studying root development in agricultural crops, T. S. VENKATRAMAN (*Agr. Jour. India*, 19 (1924), No. 5, pp. 509-514, pls. 4).—Devices for observing the relative depths and plan of root development of agricultural crops, particularly sugar cane, are described and illustrated.

Seed of root crops produced in **1923** and its market during the winter of **1923-24** [trans. title], J. C. LUNDEN (*Tidsskr. Planteavl*, 30 (1924), No. 5, pp. 770-790).—Statistics are presented showing the production of seed of various root crops and its distribution in Denmark, and comparing the quality and quantity produced with those of previous years. The domestic and foreign trade in the seed during the winter of 1923-24 is discussed, and tabular data are given showing its extent.

The grasses and fodder plants of New South Wales, E. BREAKWELL (*Sydney: N. S. Wales Dept. Agr.*, 1923, pp. VII+370, figs. 183).—This volume presents practical information on the characteristics, adaptation, distribution, cultural requirements, and uses of native and exotic grasses, alfalfa, sorghum, clover, sweet clover, crowfoot, vetch, saltbush, native fodder trees and shrubs, and miscellaneous fodder plants. Simple keys to the economic plants have been included. Pasture and meadow management, seeds, plant succession, and weeds are discussed in some detail.

Botanical characteristics and green manure value of **60** new legumes [trans. title], A. A. M. N. KEUCHENIUS (*Dept. Landb., Nijv. en Handel [Dutch*

East Indies], *Meded. Proefsta. Thee*, No. 90 (1924), pp. 44, pls. 14).—The botanical characteristics, origin, nomenclature, and green manure value of 60 leguminous plants are discussed, with tabulated agronomic notes showing field behavior, adaptation, and pests.

Experiments with growing hard-coated leguminous seeds in soil [trans. title], H. WITTE (*Svenska Mosskulturför. Tidskr.*, 38 (1924), No. 5-6, pp. 360-371).—Hard-coated seeds of red clover, alsike clover, alfalfa, and bird's-foot trefoil were sown in the spring of 1922 in six specially prepared plats each of clay, sandy, and peaty soil. The original seed also was tested in an ordinary germinator and examined at different times. It was found that after about 12 days the red clover contained about 20.5, alsike clover 37.5, bird's-foot trefoil 47.7, and alfalfa 25.2 per cent of unsprouted or hard seeds. After about one year in the germinator the figures were, respectively, 15, 33.5, 38.7, and 0.3 per cent, and after nearly 19 months 13.1, 32.5, 38.6, and 0 per cent. The hard seeds of alfalfa had practically all sprouted at the end of 4 months.

In the open soil only a small percentage of the hard seeds of red clover, alsike clover, and bird's-foot trefoil grew the first year; but of the alfalfa seeds 37.9 per cent germinated. The second growing season 65.4 per cent of the red clover, 58.3 of the alsike clover, and 61.9 per cent of the bird's-foot trefoil seeds grew as compared, respectively, with 71.5, 65.4, and 68 per cent, the total number sprouted up to and including the growing season of 1924.

The average seed growth of all the crops amounted to 54.2 per cent on clay soil, 67.2 on sandy soil, and 72.8 per cent on peaty soil. With the exception of alfalfa, a larger percentage of hard seeds, as compared with the growth in the germinator, grew in the open soil. In general, the hard-coated seeds did not produce very thrifty and winter-resistant plants.

New American Meibomias, S. F. BLAKE (*Bot. Gaz.*, 78 (1924), No. 3, pp. 271-288, pl. 1).—A dozen new species of Meibomia (*Desmodium*) from Mexico and Central and South America are described.

Alfalfa for Vermont, E. VAN ALSTINE (*Vt. Agr. Col. Ext. Circ.* 32 (1924), pp. 20, figs. 4).—Practical suggestions for growing alfalfa in Vermont.

Altaswede red clover, G. H. CUTLER and G. F. H. BUCKLEY (*Alberta Univ. Col. Agr. Bul.* 4 (1923), pp. 19, figs. 6).—Altaswede, a selected strain of late Swedish red clover developed in the department of field husbandry of the University of Alberta, is said to behave as a perennial and to possess an extensive root system, a high degree of winter hardiness, and fair drought resistance. Production in the year of planting is not high, due to the peculiar low-spreading growth. In the second and succeeding years the growth of Altaswede is distinctly tall and thick, with a heavy yield of forage. The late development of the variety, as shown by its blooming habit, makes it especially well suited to Alberta conditions. Cooperative trials indicate that Altaswede is suitable for all except the driest nonirrigated sections of the Province.

Nearly 8 bu. of seed per acre has been produced by this clover. Its seed resemble those of other red clover except being somewhat smaller and presenting a golden yellow appearance when viewed in bulk. About 60 per cent of the seed are pure yellow in color and the balance light purple and yellowish purple. Rather limited germination tests indicate that the seed of Altaswede may not develop hard impervious coats and that scarifying may not be necessary.

Cultural and field practices are suggested for growing Altaswede for forage and seed.

"Hard seeds" and broken seedlings in red clover, A. NELSON (*Bot. Soc. Edinb. Trans. and Proc.*, 29 (1923-24), pt. 1, pp. 66-68).—Although the percent-

age of hard seed was reduced when abrasive machinery was used on large, well-developed red clover seed, the increased number of broken seedlings left the declarable germinating percentage as low as or lower than before treatment. This adverse condition did not obtain with a smaller type of seed.

White clover (*Trifolium repens* L.), A. G. ERITH (*London: Duckworth & Co., 1924, pp. 10+150, figs. 81*).—This monograph on white clover, similar in design to that of Percival on the wheat plant (*E. S. R., 46, p. 837*), deals in its successive chapters with the seed, germination and the seedling, the root system, the stem, the leaves, the inflorescence, the flower, the development of the flower, classification, teratology, and varieties and their agricultural value. A bibliography of 125 titles is appended.

Check-row planting of maize, H. G. MUNDY (*Rhodesia Agr. Jour., 21 (1924), No. 5, pp. 543-549*).—Experiments at the Salisbury, Rhodesia, Experiment Station, supported by the experience of experiment stations in the United States, appear to show that although checkrowing may be advisable for better weed control, it does not in itself result in yields heavier than those normally obtainable from drilled corn. Number of plants per acre appears to be the deciding factor, and reduced yield may follow when the stand exceeds or falls short of the optimum as indicated by rainfall, soil fertility, and variety.

Cotton growing in Salvador, F. CHOUSSY (*Cultivo del Algodón en El Salvador. San Salvador: Dir. Gen. Agr., 1924, pp. 104, figs. 35*).—With particular application to Salvador, this publication discusses the environmental and cultural needs of cotton, preparation and marketing of the fiber, and governmental regulations concerning the crop.

Oats: Their varieties and characteristics, H. HUNTER (*London: Ernest Benn, Ltd., 1924, pp. 131, pls. 4, fig. 1*).—This practical handbook, introduced by R. H. Biffen, discusses the origin, botanical characters, and species of oats, and describes and classifies the species of *Avena* and the varieties pertaining thereto. In a chapter on the chemical composition of oat grain, the suitability of cultivated varieties to different soil and climatic conditions is pointed out. Discussion of seed selection and the production of pure seed concludes the volume.

Variations in varieties of canning peas, F. H. HALL (*New York State Sta. Bul. 526 (1924), pp. 3-20*).—Plat tests were made with strains of each of 11 well-known varieties of canning peas and with 8 other promising varieties. The characteristics of each variety and strain are set forth with tabulations showing the total yields, the total and graded yields of peas, the grade percentage, the estimated returns per acre, the crop weight, the number and relationships of vines, pods, and peas, and the classified weights of refuse from the several strains.

The variations found between crops of the same variety of canning peas, grown under uniform conditions but from seed from different seed growers, extend to practically every character that canners consider when selecting varieties. In many cases factors of prime importance to canner or grower have varied as widely or more between strains as between varieties of similar general character.

Horal, Late Alaska, Allan Canner, and Badger of the new varieties showed much promise for New York conditions. Lincoln and Richard Seddon proved of splendid quality, and further trials were suggested.

Canning peas (*New York State Sta. Bul. 526, pop. ed. (1925), pp. 3*).—A popular edition of the above.

Anatomy, embryology, and ecology of *Arachis hypogea*, E. L. REED (*Bot. Gaz., 78 (1924), No. 3, pp. 289-310, pls. 2, figs. 11*).—Field, greenhouse, and laboratory studies were concerned with the anatomy, embryology, and ecology of the peanut.

Although the peanut (*A. hypogea*) is a native of Brazil, its wild ancestor is not known, and while a member of the Leguminosae, it has not been definitely placed as to its affinities. It grows well and fruits abundantly in hot, relatively dry climates, although the leaves are typically mesophytic with a few xerophytic characters. It is a low annual which, by a lengthening of the internode just below the ovary, pushes its pod below the surface of the soil where the seeds are ripened. Its root system is of the taproot type with root hairs of two kinds, normal root tip hairs, and rosettes at the base of the lateral roots. The hairs are so scantily developed in field-grown plants that their influence as absorptive organs is negligible.

The seed is a straight embryo, and consists of two large cotyledons, a short hypocotyl, and a plumule composed of a terminal and two lateral buds. The mature embryo sac has eight nuclei and numerous starch grains. The antipodals soon disappear. The endosperm nucleus forms numerous free nuclei, which later form a single layer of cells lining the sac. The fertilized egg produces a massive proembryo, which early differentiates into the embryo region and the suspensor. The gynophore has typical stem structure. There is a large pith, about 13 vascular bundles, both fascicular and interfascicular cambium, and a cortex. It responds to positive geotropism.

[Fourth and fifth annual reports] of the Nebraska Potato Improvement Association, edited by H. O. WERNER and W. MORROW (*Nebr. Potato Impr. Assoc. Ann. Rpts.*, 4 (1922), pp. 146, figs. 7; 5 (1923), pp. 183, figs. 13).—Papers presented at the fourth annual meeting of the association at Alliance in December, 1922, included Factors Affecting Freight Rates on Potatoes, by T. Brown; Marketing the Western Nebraska Potato Crop, by O. D. Miller; Report of Colorado [Potato] Experiment Station, by W. C. Edmundson; The Management of Western Nebraska Soil, by W. W. Burr; Seed Potato Certification in Minnesota, by A. G. Tolaas; and Seed Potato Certification in Nebraska in 1922 and Plans for 1923, by H. O. Werner.

Among the papers presented at the fifth annual meeting at Chadron in December, 1923, were the following: Nebraska Certified Seed Potatoes in Louisiana, by G. L. Tiebout; Potato Diseases, by R. W. Goss; and Preventing Tuber Injury for Control of Dry Rot, The Present and Future of Seed Potato Certification, and Significant Experimental Results on Potato Culture, all by H. O. Werner.

Rice, T. F. MAIN (*Bombay Dept. Agr. Ann. Rpt.*, 1922-23, pp. 105, 106).—In connection with breeding work with rice in Sind, K. I. Thadani observed that about 2 per cent of the flowers of most of the rice varieties never opened, and that a certain percentage of the open flowers gave worthless kernels. Total sterility from these two causes occasionally rose as high as 32 per cent of the grain in the panicle. Observations in 1922-23 showed rice fertilization to take place between 7.30 a. m. and 12.30 p. m., with the maximum activity from 10.30 a. m. to 11.30 a. m. The temperature corresponding to these periods ranged from 86° to 99° F.

Rice in Egypt [trans. title], J. ANHOURY (*Bul. Union Agr. Egypte*, 22 (1924), No. 155, pp. 91-107).—The production of the crop in Egypt is discussed from historical, cultural, irrigation, and economic viewpoints, with comment on the merits of varieties.

Different varieties of rye as nurse crops in seeding meadows [trans. title], H. WITTE (*Svenska Mosskulturför. Tidskr.*, 38 (1924), No. 5-6, pp. 382-385).—In six varieties of rye used as nurse crops for a clover and grass mixture sown for hay production the stiffness of the straw was in direct proportion to the yields of hay produced, and it is concluded that the choice of

varieties for this purpose is important. The average yield of hay after Stålråg and Stormråg, stiff-strawed varieties, was at the rate of 5,935 lbs., and after Wasaråg and Gråråg, weak-strawed varieties, at the rate of 4,418 lbs. per acre.

The injurious after-effects of sorghum, J. F. BREAZEALE (*Jour. Amer. Soc. Agron.*, 16 (1924), No. 11, pp. 689-700, fig. 1).—When kafir and corn were grown in competition, little evidence was obtained to show that the kafir plants are more vigorous feeders than corn. Experiments wherein wheat was grown in tap water, alone and with additions of stubble of corn, sorghum, and cowpeas, respectively, during and after decomposition of the stubble and in solutions of decomposed stubble, gave results indicating that the injurious after-effect of sorghum is due to the presence of a toxic body formed during the decomposition of the stubble. This toxic body seems to be soon volatilized or decomposed. During the decomposition of the stubble, and while the toxic body is still in the soil, the flora generating carbon dioxide is largely killed off. With the cessation of the evolution of carbon dioxide, a new equilibrium appears to be established in the soil, in which the sodium zeolite exists in excess over the calcium salt. This causes a deflocculation of the soil.

See also an earlier note by Sewell (*E. S. R.*, 49, p. 332).

The sugar beet industry, W. F. GEDDES (*Sci. Agr.*, 5 (1924), No. 4, pp. 101-112 figs. 4).—In a brief review of the sugar beet industry in the United States and Canada, which outlines the process of sugar extraction and summarizes sugar beet experiments carried on by the Manitoba Agricultural College, the author does not consider that the experimental results so far obtained would warrant the establishment of a sugar beet factory in Manitoba with the large capital expenditure involved.

Sugar beets in Minnesota, F. W. MCGINNIS (*Minn. Univ. Agr. Ext. Spec. Bul.* 90 (1924), pp. 12, figs. 7).—Practical information is given concerning the production of sugar beets in the State.

Tests with sugar beets, E. E. DOWN (*Michigan Sta. Circ.* 66 (1925), pp. 8, figs. 2).—Tabulated results of comparative tests of sugar beet seed (*E. S. R.*, 51, p. 38) from American and European sources, made in cooperation with the U. S. Department of Agriculture, show acre yields of beets and recoverable sugar, sugar percentages, and purity coefficients.

Observations on seed production in beets during the first year [trans. title], MUNERATI (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 13, pp. 604-606; also in *Com. Cent. Fabric. Sucre France, Circ. Hebd.*, 36 (1924), No. 1857, pp. 507-509).—In a discussion of the phenomenon of premature seed production in sugar beets (*E. S. R.*, 50, p. 832), the author reports that when ordinary types of beets were subjected to intense nocturnal illumination, a number of individuals with from 8 to 10 leaves showed a tendency toward seed production about 1 month after planting. From 25 to 30 per cent were in full bloom 60 days after planting, and after 120 days, ripe and perfect glomerules were harvested. Under analogous conditions of continuous illumination, hemp continued to grow more than 6 months without differentiating, whereas under normal field conditions hemp from the same seed showed differences from the third month, and had the normal ratio of males to females.

The effect of increased applications of sodium nitrate on the quality of sugar beets [trans. title], J. URBAN and J. SOUČEK (*Ztschr. Zuckerindus. Čechoslovak. Repub.*, 48 (1924), No. 48, pp. 449-456).—The results of 66 similar cooperative fertilizer experiments with sugar beets carried on in Czechoslovakia under different soil and climatic conditions were studied to determine the influence of sodium nitrate on the sugar content and nitrogen content of

the root. Thrice replicated plats of equal areas received applications of sodium nitrate equivalent to 0, 100, 200, 300, and 450 kg. per hectare (0, 89, 178, 267, and 400.5 lbs. per acre). As general averages the respective yields of beets per hectare amounted to 32,000, 33,800, 35,400, 36,900, and 37,400 kg.; sugar content, 19.22, 19.16, 19.2, 19.08, and 19.02 per cent; yields of sugar per hectare 6,150, 6,470, 6,790, 7,040, and 7,120 kg.; purity of juice 90.4, 90.4, 90.2, 90.2, and 90.1; and nitrogen content of root 0.15, 0.153, 0.157, 0.162, and 0.165 per cent.

The average results are not held applicable to all the soils. On certain soils, about 58 per cent of the tests, sodium nitrate apparently reduced the sugar content about 0.75 per cent, whereas in 23 per cent of the fields an average increase of about 0.83 per cent was observed. In the remainder of the plats, the quality was similar to that of untreated beets. Where the beet yields on the plats receiving no nitrate were themselves heavy, the nitrate applications reduced the sugar content and the purity of juice and increased the nitrogen content. On poor fields the nitrate favorably affected both yields and quality.

"Light and air" in cane cultivation, A. H. ROSENFELD (*Sugar* [New York], 26 (1924), No. 12, pp. 588-591.)—Recent advocacy by several others of extremely wide spacing of sugar cane led the author to review experimental results throughout the sugar-producing regions of the world, and to conclude that sugar cane should be planted as closely as is consistent with proper cultivation with modern implements. This optimum row width appears to be 5 ft. for the thicker types of cane, such as the Cheribon, Lahaina, B. 208, H. 109, B. H. 10 (12), and S. C. 12/4, and from 5.5 to 6 ft. for rather luxuriantly stooling canes, such as the POJ Java seedlings and the East Indian types.

The nature and practical measurement of frost resistance in winter wheat, R. NEWTON (*Alberta Univ., Col. Agr. Research Bul.* 1 (1924), pp. 53, figs. 5).—Continued study was made of the factors determining frost resistance in winter wheat and of methods for measuring this quality which may have practical application in breeding and selecting hardy varieties. Part of this work has been noted earlier (*E. S. R.*, 51, p. 237).

Preliminary results by a method based on the composition of the fresh tissue and its press juice indicate a wide variation in the distribution of nitrogen between cell colloids and aplastic forms. It appears probable that hardy varieties accumulate during the hardening process more protein in the form of cell colloids. The possible utility of the "gold number" as a measure of the quality of cell colloids is pointed out.

The ratio of amino nitrogen to total nitrogen increased in all varieties in the late fall, indicating an association of protein splitting with the later stages of the hardening process. Some correlation was found between the sugar content of hardened leaves and hardness. The value of sugar as a protection against the precipitation of proteins by freezing was demonstrated by the use of press juice from greenhouse leaves. Precipitation was largely inhibited by the addition of 8 per cent of dextrose, and completely so by 8 per cent of sucrose. The rate of sugar loss from the leaves in late fall was found to be somewhat greater in nonhardy varieties. A more profound and stable dormancy in the hardy varieties, characterized by a slower rate of respiration, is suggested as a possible explanation.

Baking qualities of Mesopotamian wheat (*Bul. Imp. Inst.* [London], 22 (1924), No. 3, pp. 284-292).—Milling and baking tests were made by J. Kirkland on a number of local and introduced varieties of durum and vulgare wheat grown at Bagdad. The flours from these wheats varied in their behavior in bread making, being comparable to the flours from Indian wheats showing similar variations. In the United Kingdom these wheats would be used for

mixing with more valuable Manitoba or Australian wheats. While all the samples listed probably would be suitable for this purpose, continuation of cultivation trials is suggested in order to determine the varieties attaining the best quality after acclimatization.

Growing registered seed in Alberta, G. H. CUTLER and J. R. FRYER (*Alberta Univ., Col. Agr. Bul. 3* (1923), pp. 32, figs. 8).—Designed to present all available information concerning the growing of registered seed, this publication discusses the status of registered seed production in Alberta and elsewhere in Canada, and the practices involved in growing, harvesting, storing, marketing, and exhibiting registered seed.

Inspection of agricultural seeds, E. G. PROULX ET AL. (*Indiana Sta. Bul. 285* (1925), pp. 63, fig. 1).—The purity, germination percentage, and hard seed and weed seed content are tabulated for 727 official samples of agricultural seed analyzed during 1924.

HORTICULTURE

[**Horticultural investigations at the Delaware Station**], L. R. DETJEN (*Delaware Sta. Bul. 139* (1925), pp. 21, 22).—Fertilizer studies with the apple again indicated (E. S. R., 51, p. 140) that nitrogen is the limiting factor in production on Delaware soils. However, nitrogen combined with either phosphoric acid or potash, or both, gave the largest and best quality yields. A qualitative study of nitrogen for the peach showed no difference in favor of any particular source.

Cabbage breeding investigations continued to show the difficulty of maintaining pure lines because of the frequent occurrence of self-incompatibility. In one strain, for example, known as the zinnia rosette, one of four selected plants failed to produce a single viable seed. The spindle or pointed type was found to breed quite true to type.

[**Horticultural investigations at the Idaho Station**] (*Idaho Sta. Bul. 135* (1925), pp. 31, 32, 33, 34, 35).—The considerable extent to which the Ben Davis apple has been utilized in breeding studies is indicated in a tabulated statement of the parentage of seedlings fruiting in 1922 and 1923. Apple fertilizer studies conducted in the Moscow, Coeur d'Alene, and Lewiston districts failed to show any material advantage from the use of fertilizers. The value of adding spreaders to arsenate of lead apple sprays was indicated by an 8 per cent better control where such spreaders were used. Little difference was found between various commercial spreaders.

Studies in vegetable seed production again indicated the potential possibility of developing this industry in Idaho. A study of 12 strains of New York head lettuce showed only slight variation in germination, shape, and trueness to type. Lettuce yields were increased by the liberal application of phosphoric acid and potash. Of the many tomato varieties tested in an attempt to discover one better adapted to northern Idaho than the Earliana, the Puget Sound Special, Atlantic Prize, June Pink, Dwarf Ponderosa, King of Earliest, and Moore Early showed considerable merit. The Dwarf Champion and Puget Sound Special, together with certain station selections, apparently possessed some resistance to western tomato blight.

Protecting South Carolina from plant diseases and crop pests, J. A. BERLY (*South Carolina Sta. Circ. 32* (1924), pp. 3-32, figs. 22).—In connection with a statement of the activities of the State Crop Pest Commission in preventing the entrance and dissemination of various insect and fungus pests, the sale of inferior insecticides and fungicides, etc., various pests, both those

already present and those whose entrance from other localities is deemed possible, are described and illustrated.

[**Horticultural investigations at the Washington Station**] (*Washington Col. Sta. Bul.* 187 (1924), pp. 38, 39, 61-64, 106, 107).—Repeated chemical examinations by J. L. St. John of stored Jonathan apples showed that total and reducing sugars increase, while the alcohol-insoluble acid hydrolyzable material continues to decrease during storage as during growth. Attempts to use chemical examinations as a means of determining the stage of maturity of apples showed no progressive variations in ash, acid, total or reducing sugars, or in H-ion concentrations. The protein showed a tendency to decrease, and the alcohol-insoluble acid hydrolyzable material showed a progressive decrease as the time of picking approached.

Work by O. M. Morris indicated that, under average orchard conditions, alfalfa cover crops are undesirable in young apple orchards. Among summer planted cover crops, spring vetch, hairy vetch, and biennial sweet clover proved to be equally capable of germinating and establishing themselves in soils irrigated once every three or four weeks. Red clover, field peas, and alsike clover seemed unable to make a quick and satisfactory start under such conditions.

Work carried on at Wenatchee by Morris and W. A. Luce indicated a definite relation between vegetative growth and the color of the fruit. Apparently it was possible with cover crops to stimulate soil fertility beyond the point of best quality production in apples.

Morris, F. L. Overley, and H. J. Jensen, working at the Irrigation Substation at Prosser, found that apple trees standing in dry ground had a higher leaf temperature than trees well supplied with water. Furthermore, such differences were manifested several days before any external evidence, such as checked growth of rapid-growing twigs, was visible.

Observations by Morris, Luce, and T. R. Hall upon untreated and treated pruning wounds indicated the advisability of painting large wounds with waterproof paints. Thick lead paints and water glass gave good results, while creosote and coal-tar paints, though preserving the wood, killed the young cambium layer.

Grape pruning studies by Morris and Hall indicated that short spurs do not give as good results, either in quality or quantity of grapes, as do medium length spurs. Vines pruned to a short-spur system produced more shoots from the old secondary winter buds than were produced under other systems.

An attempt by Overley to discover a method of determining the maturity of Jonathan apples during storage showed that the hardness of the fruit is the most directly measurable character.

Cranberry investigations, conducted by D. J. Crowley, showed that serious frost injury results from a temperature of 32° F. during blossoming time, and that 28° will injure berries when nearly mature. About 5 per cent of ripe cranberries freeze at a temperature of 25°. The Howe variety was found to be the most resistant to low temperature.

Growing tomatoes for the canning factory, H. D. BROWN (*Indiana Sta. Bul.* 288 (1924), pp. 27, figs. 19).—A general discussion, taking into consideration such details as extent and distribution of tomato growing in the State, plant production under protection and in the open, the value of selected seed, superiority of home-grown plants, field setting, culture, control of diseases and insect pests, etc.

Asexual propagation as an aid to the breeding of rootstocks, W. S. MALLOCH (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 10, pp. 515-521, pl. 1).—Herein are presented in tabular form, with discussion, the results of an in-

vestigation conducted at the University of California in 1923 upon root and vegetative development in hardwood cuttings of divers species obtained from California and Connecticut, planted outdoors in February, and lifted for examination in May of the same year. While many varieties of apple and pear (*Pyrus malus* and *P. communis*) callused, none of the cuttings of these two species formed roots. Certain European plums, such as Clyman, Peach, Pond, and Sultan, and the Japanese plum varieties Satsuma and Combination, formed roots. Roots were recorded on one or two obscure forms of peach, but in general peach varieties failed to show root formation. Among the *Prunus* species to root quite readily were *P. besseyi*, *P. pumila*, *P. cerasifera*, *P. munsoniana*, and *P. spinosa*, and some of the hybrids involving one of them. The author points out that the environmental conditions surrounding the tests were not ideal for the rooting of cuttings, and hence that even better results might be anticipated under more favorable conditions.

Some factors influencing root development, R. G. HATTON, N. H. GRUBB, and J. AMOS (*East Malling [Kent] Research Sta. Ann. Rpt. 1923, pp. 110-119, pls. 8*).—A study of the development of comparable roots of a clonal apple rootstock variety worked with Bramley Seedling and Stirling Castle apple scions showed a positive quantitative effect of the scion on the root, the average weight of the Bramley tree roots being approximately double that of the Stirling Castle roots. No qualitative effects were noted.

In the case of Lord Derby and Tyler Kernel apples worked on three clonal rootstocks it was found that Lord Derby trees actually developed a measurably larger proportion of fibrous roots on all three stocks. The tendency of the Lord Derby variety to influence the proportion of fibrous roots was further shown in an examination of four varieties worked on two clonal rootstocks. However, since the highest percentage of fibrous roots on one stock was lower than the lowest percentage on the other, the authors point out that scion influence is subordinate to the general character of the roots. Marked varietal differences were noted in respect to the proportion of root weight to total weight of the tree. The scion apparently had little influence upon the location of the side roots, although in the Grenadier variety a striking exception was observed, more than half the roots originating from the top area of the main root.

Observations upon the effect of top pruning on root development accorded, in general, with the results obtained by Chandler (*E. S. R.*, 49, p. 637), namely, that severe top pruning reduces root growth. Using as material clonal apple trees from which all side roots had been removed the authors found that unpruned trees made much greater root and much less top growth than did pruned trees. Trees top pruned in July also made less growth than control trees.

In comparing five preplanting root treatments, namely (1) control, (2) removal of fibrous roots only, (3) removal of coarse roots only, (4) removal of all side roots, and (5) exposure of roots to drying, it was found that, in general, the young trees had to practically renew afresh their root development subsequent to transplanting. The retention of fibrous roots was of less importance than coarse roots. However, in many instances the old fibrous roots enlarged into coarse roots. Very satisfactory root formation was secured in lot 4, from which all side roots had been removed. In respect to the effect of root pruning on top development, the removal of fibrous roots had much less inhibiting effect than the removal of coarse roots or all side roots. Root pruning had less effect than top pruning in reducing new root and vegetative development.

Trees planted in doubly tilled soils did not grow measurably different from those under which the subsoil was rammed in order to create an artificial

hardpan. The ramming of soil about the roots had no significant effect. However, in the case of Bramley Seedling trees on a clonal rootstock, depth of planting affected the location of root development. In the case of deeply planted trees there was a noticeable tendency for the principal root development to be shifted upward, although in no case did the scion itself send forth roots. Only those trees planted on the surface and mounded up showed inferior top growth. Working with other rootstocks, evidence was obtained to indicate that the variety of rootstock affected the results of depth of planting studies. In a dry season shallow-planted trees suffered more from drought and recovered quicker following rains than did deeply planted trees. A tendency was noted for shallow planting to increase fruit-bud formation. Deep planting did not prevent the enlargement of the union, and moderately deep-planting apparently favored better anchorage of the tree.

A test to determine whether environment has produced different strains of Baldwin. G. H. HOWE (*Amer. Soc. Hort. Sci. Proc.*, 21 (1924), pp. 62, 63).—A study at the New York State station of 84 Baldwin apple trees obtained from 40 locations in 15 States failed to show a single variation of sufficient significance to lead to the conclusion that there are different strains of this widely distributed apple variety.

Pollination and the sterility problem. J. H. GOURLEY (*Ohio State Hort. Soc. Proc.*, 57 (1924), pp. 18–23).—Apple pollination studies conducted by the Ohio Experiment Station in 1923 are briefly reported in connection with a general discussion of the pollination problem.

Stayman Winesap blossoms pollinated with Wealthy, Grimes, Delicious, Baldwin, Jonathan, Ansee, Rome, Yellow Transparent, York Imperial, and Stayman Winesap gave respective sets of fruit of 0.6, 17.6, 5.6, 0, 11.1, 20.1, 43.3, 51.6, 60.6, and 0. The inferior value of Stayman Winesap as a pollen parent was shown in a test conducted at Chardon, wherein three pairs of trees each including a Stayman Winesap were inclosed in tents each containing a hive of bees. The three partners, Baldwin, Jonathan, and Yellow Bellflower, set 4.9, 1.5, and 0.16 per cent, respectively. In hand pollinations at Chardon, the Stayman Winesap pollinated with Grimes and McIntosh gave 17.9 and 19.3 per cent sets, respectively, while the reciprocal crosses yielded 1.1 and 0.9 per cent.

Pollination of the sweet cherry. W. P. TUFTS and G. L. PHILP (*California Sta. Bul.* 385 (1925), pp. 3–28, figs. 11).—Pollination investigations conducted in various cherry-producing sections of California during the years 1916–1924 showed all sweet cherry varieties studied to be practically sterile and in some instances intersterile. The highest percentage of set, 3.5, obtained in self-pollination tests was in the case of Bing in 1917. Seven varieties tested for only one or two years set no fruit. However, all varieties tested over a period of years yielded some fruit in some year.

The blooming periods of varieties determined incidental to cross-pollination investigations showed that certain varieties are completely past their period of effective blossoming before others begin to bloom. Fortunately, the blooming periods of the Black Tartarian and the Black Republican varieties, found to be valuable pollinizers, usually sufficiently overlapped those of the late-blooming varieties to allow adequate cross-pollination. Determinations of pollen production in 18 varieties revealed only one shy pollen producer, namely, Centennial. Tests in 12 per cent cane sugar solution showed satisfactory pollen germination for most varieties. Observations indicated that the presence or absence of bright, warm weather just preceding and during the blossoming period materially affected the viability of the pollen.

The results of extended cross-pollination tests, which are set forth in tabular form, led the authors to suggest compatible and incompatible varietal combinations. Napoleon, Lambert, and Bing were found to be intersterile, which was also true of Advance and Rockport and of Early Purple and Rockport. Unfortunately, it was found that in certain varieties there exist outwardly similar strains which when used as pollinizers for the same variety give widely divergent results. For example, in the Vaca Valley, the authors found five kinds of Black Tartarian which gave sets on a single Napoleon tree ranging from 3 to 40 per cent.

The importance of insects as pollinizers in cherry orchards was indicated in four tests wherein emasculated and unprotected cherry blossoms, apparently unvisited by bees or other insects, yielded sets of fruit ranging from 0.02 to 0.5 per cent.

In practical conclusion, the authors point out the necessity of planting compatible varieties, so arranged as to allow easy cross-pollination and at the same time to facilitate orchard management operations. It is recommended that, in varieties existing in the form of two or more similar strains differing in pollinating capacities, the valuable strains be isolated and propagated. It is advised that the unsatisfactory pollination often occurring in solid blocks of cherries may be remedied by grafting in each tree a branch of a compatible variety. In extreme cases temporary relief may be obtained by placing flowering branches of a compatible variety in jars of water distributed throughout the orchard.

The nectarine as a future commercial fruit in New York State, R. WELLINGTON (*Amer. Soc. Hort. Sci. Proc.*, 21 (1924), pp. 60-62).—Unprotected seeds saved from nectarine trees growing in a mixed peach and nectarine orchard on the New York State Station grounds gave rise in only one instance, namely, that of the Quetta variety, to a peach. Based on the supposition that the fuzz or tomentum of the peach is a dominant character, the results are deemed to indicate that the nectarines in the orchard are largely self-fertilized. The origin at the station of a promising nectarine designated as Hunter is again briefly discussed (*E. S. R.*, 49, p. 338). That the nectarine has not become a popular fruit in the United States is believed to be due to the fact that the Americans have usually grown European varieties without attempting to develop varieties adapted to our soils and climate.

Raspberry investigations, N. H. GRUBB (*East Malling [Kent] Research Sta. Ann. Rpt. 1923*, pp. 128-130).—Similarly to an earlier report (*E. S. R.*, 48, p. 737), the author discusses briefly the results of varietal and cultural tests with the raspberry. A variety hitherto known as Baumforth Seedling B is now deemed to be Northumberland Fillbasket, and one known as Fillbasket A is probably Fastolf. Of 10 varieties which have fruited at the East Malling Station for more than one year, Pyne Royal, for the fourth consecutive season, led in production. Of 30 varieties fruiting for the first time in 1923, Lloyd George was the highest yielder. Baumforth Seedling B produced about 20 per cent more fruit on unmanured soil, while Pyne Royal gave nearly 170 per cent greater yield on manured land. It is believed, however, that these figures may have been affected by the presence of mosaic disease.

The tea plant, O. F. SCHLEINKOFER (*Der Tee. Munich: Michael Beckstein, 1924*, pp. 126, pls. 26, figs. 5).—This book, illustrated with numerous reproductions of tea gardens and their architectural features and various operations in the growing, manufacture, and handling of the crop, contains a general discussion of tea growing in the region embracing eastern and southern Asia.

Second report of the tree protection examining board, covering the three years ending June 30, 1924, W. E. BRITTON, G. P. CLINTON, and W. O. FILLEY (*Connecticut State Sta. Bul.* 263 (1924), pp. 141-155, pls. 8, figs. 2).—The text of an act requiring the examination and licensing of parties engaged in professional tree repair work in Connecticut is again presented (E. S. R., 46, p. 340), in connection with a brief statement concerning operations under the act during the three years ended June 30, 1924. There is also included a brief article by Filley entitled Tree Surgery, which points out the need of research in determining the best methods of treating tree wounds and which questions the actual value of much tree repair work done in the past. A paper entitled Cavity Work, by J. F. Collins, contains the statement that his observations indicate that a large percentage (90+) of tree repairing in the past has resulted in failure, decay generally setting in behind the cement fillings. It is believed that the use of cement by untrained persons for filling other than small and globular cavities can not be conscientiously recommended.

The rose book, edited by W. MÜTZE and C. SCHNEIDER (*Das Rosenbuch. Berlin: Gartenschönheit*, 1924, pp. 136, pls. 7, figs. 87).—Beautifully illustrated, partly in color, this handbook contains information concerning the history and the development of the modern rose and lists a large number of present-day varieties, grouped according to their color and usefulness.

FORESTRY

The forests (*Les Forêts. Rome: Inst. Internatl. Agr., Serv. Statist. Gén.*, 1924, pp. VII+425, figs. 2).—A compilation of statistics concerning the size and distribution of the forests, annual lumber cut, important species, forest administration, etc., in the various countries of the world.

Our hardy conifers, edited by E. SILVA TAROUCA and C. SCHNEIDER (*Unsere Freiland-Nadelhölzer. Vienna: Hölder-Pichler-Tempsky*, 1923, 2 ed., rev. and enl., pp. XII+315, pls. 18, figs. 319).—A second enlarged and revised edition of the work previously noted (E. S. R., 30, p. 742).

Artificial reproduction of redwood (*Sequoia sempervirens*), W. METCALF (*Jour. Forestry*, 22 (1924), No. 8, pp. 873-893).—This paper, dealing with the reproduction of redwood, is a summary of information, for the most part previously noted (E. S. R., 48, p. 540).

Revised volume tables for second-growth redwood, D. BRUCE and F. X. SCHUMACHER (*Jour. Forestry*, 23 (1925), No. 2, pp. 148-155).—Finding that previously prepared volume tables (E. S. R., 46, p. 342) were inadequate in the range of values included, the authors herein present revised and extended tables having approximately twice the range of the preliminary tables and containing minor corrections for values of small trees. There is also added a new table giving volumes in cubic feet.

Growth and its relation to thinning sample plots studies in mixed hardwood stands, C. H. GUISE (*Jour. Forestry*, 23 (1925), No. 2, pp. 156-159).—Measurements taken in sample plots of mixed hardwoods, located in Cayuga County, N. Y., and subjected in the beginning to different grades of thinning, showed the greatest actual increase in diameter in the heavily thinned area. Although the control plot contained the greatest volume of wood, the volumes on the thinned plots, especially on the heavily thinned area, were found to be increasing at a much more rapid rate than on the control, leading the author to suggest that in 5 or 10 years the thinned plots will equal in volume the control. The mortality was appreciably higher in the control area, and indications were that this difference would become more acute in the near future, since many trees in this area were in a poor state of health due to crowding.

On the relation of the source of *Quercus pedunculata* acorns to the growth of the resulting trees [trans. title], A. CIESLAR (*Centbl. Gesam. Forstw.*, 49 (1923), No. 4-6, pp. 97-149, figs. 3).—As a result of studies begun in the spring of 1904 in the Mariabrunn (Austria) Forestry Experiment Station, in which 21 lots of *Q. pedunculata* acorns obtained from widely separate points in Europe were carefully compared in relation to germination and the rapidity and manner of growth of the resulting seedlings, the author concludes that the place of origin is an extremely important factor in the culture of this species, and recommends that acorns be obtained from areas having rainfall, temperature, and soil conditions comparable to those of the desired planting locality. In comparing the progeny of heavy and light weight acorns, it was found that heavy acorns resulted in larger and more rapidly growing seedlings. This advantage, however, disappeared entirely by the end of the eighteenth year. Acorns from a cooler climate yielded frost-resistant seedlings, while those from warmer climates gave tender plants. Considerable variation was noted in the tendency of the several lots to produce straight or crooked stems, and in general straight trunks were associated with larger diameters. Leaf size was found to be a reliable index to vigor, being closely associated with growing capacities. Oaks from acorns gathered near the ocean colored later in the autumn than did those gathered from farther inland.

Relative water-holding capacity of sphagnum and tree moss, J. F. KUMMEL (*Jour. Forestry*, 23 (1925), No. 2, pp. 181, 182).—Studies carried on at the Wind River Nursery, Stabler, Wash., showed that sphagnum moss is not only capable of absorbing twice as much water as ordinary tree moss found on trunks and large branches of hardwoods growing in moist environments, but also is able to retain moisture for a longer period.

The grazing of cattle and horses in pine plantations, P. W. STICKEL and R. C. HAWLEY (*Jour. Forestry*, 22 (1924), No. 8, pp. 846-860).—Studies, conducted by the Yale School of Forestry, upon the effects of grazing in red and white pine plantations indicated that limited cattle grazing may be of decided benefit to young plantings as follows: (1) In reducing fire hazards by the close cropping of grasses and shrubs, (2) in the suppression of hardwood sprouts, which are eaten in preference to the evergreens, and (3) in the development of deep paths which may serve as fire lines in combating running fires. On the other hand, because of their biting habits and general restlessness, horses were found much more destructive than cattle, and it is recommended, therefore, that in winter especially they be entirely excluded.

Report of the National Forest Reservation Commission for fiscal year ended June 30, 1923 (*U. S. Senate*, 68. Cong., 1. Sess., Doc. 59 (1924), pp. V+37, pls. 8, fig. 1).—This illustrated pamphlet contains information concerning accessions to and changes in the national forests made during the year ended June 30, 1923.

Forestry [at the Idaho Station] (*Idaho Sta. Bul.* 135 (1925), pp. 30, 31).—Observations upon black locust and catalpa plantations located at various altitudes indicated that the black locust can succeed even up to 4,500 ft. in sheltered localities, while the successful limit for catalpa is approximately 3,000 ft. Records taken in irrigated sections of southern Idaho showed that both the hardy catalpa and the black locust at 14 years of age are capable of yielding a large number of posts per acre. Posts set in alkali soils were observed to be shorter lived than those set in ordinary soils. Observations on second growth western yellow pine indicated that this species is capable of making a very rapid growth and should return a profit in the form of fuel, fence posts, and perhaps lumber.

Second report on a forest survey of Illinois: The economics of forestry in the State, H. H. CHAPMAN and R. B. MILLER (*Ill. Nat. Hist. Survey Bul.* 15 (1924), Art. 3, pp. VII+46-172).—A further contribution (E. S. R., 49, p. 341) to a comprehensive study of the forestry situation in Illinois. In the present instance the authors discuss the economic importance of wood in the State in the manufacture of farm implements, use as paper pulp, fuel, etc., and present data on the present condition of the small remaining forests.

Annual report of the director of forestry of the Philippine Islands for the fiscal year ended December 31, 1923, A. F. FISCHER (*Philippine Bur. Forestry, Ann. Rpt. Dir. Forestry, 1923*, pp. 163, pl. 1).—This is the usual annual statement (E. S. R., 50, p. 344).

Quinquennial review of forest administration in the Province of Assam for the years 1919-20 to 1923-24, with the progress report of forest administration for 1923-24, F. TRAFFORD and C. A. G. RIVAZ (*Assam Forest Admin. Qinq. Rev. 1920-24 and Rpt. 1923-24*, pp. 23+59+2, pl. 1).—This report, covering the five-year period 1919-20 to 1923-24 and the annual period 1923-24 (E. S. R., 50, p. 345), contains information concerning alterations in area, silvicultural and administrative activities, revenues, expenditures, etc.

Annual report of the Forestry Department [Uganda] for the year ended 31st December, 1923, R. FYFFE (*Uganda Forestry Dept. Ann. Rpt. 1923*, pp. 16).—In presenting the usual annual report (E. S. R., 52, p. 241), the author discusses planting activities, alterations in area, revenues, expenditures, etc.

Report of the director of forests for the year ended 31st December, 1923, E. H. F. SWAIN (*Queensland Dept. Pub. Lands, Rpt. Dir. Forests, 1923*, pp. 30).—This is the usual annual statement (E. S. R., 51, p. 44), containing information concerning silvicultural activities, forest protection, organization, surveys, timber operations, etc.

DISEASES OF PLANTS

Department of plant pathology and soil bacteriology, T. F. MANNS and J. F. ADAMS (*Delaware Sta. Bul.* 139 (1925), pp. 24-29).—In a study of diseases of the sweet potato, the authors found additional evidence to strengthen their conclusions that pox is caused by a species of *Actinomyces*.

An investigation was begun on peach yellows and little peach, in which trees were grown under screen to prevent the entrance of carriers, but the rains dissolved enough copper from the screens to defoliate the trees for several weeks.

In a study of the diseases of cucurbits and their control, the principal work was carried on with downy mildew on cantaloupes. This disease is said not to make its appearance in Delaware until early planted melons begin to net, while cucumbers showed the disease before cantaloupes. Two different brands of copper-lime-arsenate dust were used for the control of this disease with about equally good results. Treating the vines with quickly available nitrogenous fertilizers did not check the attack of the disease. A species of *Alternaria* was found commonly occurring as a saprophyte on leaves attacked by *Macrosporium cucumerinum*. Inoculation experiments were conducted with this fungus on a considerable number of important truck crops, and, among the cucurbits, summer squash and cucumber showed the greatest resistance. Infections were secured on tomato and potato, but they are said to have borne no resemblance to the early blight of these hosts.

Some attention was given to diseases of canning peas, and the bacterial leaf spot due to *Bacterium pisi*, root rot, and a fungus described as *Aphanomyces* sp. associated with the root rot were observed.

Notes are given on the value of casein compounds in connection with orchard spraying, on apple scab studies, and on corn root rot. A test made of corn from the 1922 crop stored in the laboratory indicated that there was a reduction in the prevalence of the fungi causing root rot in corn, particularly of *Diplodia zeae* and *Gibberella saubinetii*.

In connection with some extension work on the control of black rot of grapes, additional research work was carried on with the organism. It was found that dry weather may arrest black rot and that infection may take place any time after the new shoot is 1 in. long, while the macroscopic lesions may not appear until the fruit is two-thirds or more grown. After initial infection has taken place no number of sprayings can control the disease. The primary infection on the basal nodes of new shoots is considered the source of carrying over infection for the succeeding year.

Plant pathology (*Idaho Sta. Bul. 135 (1925), pp. 35-39*).—In studies on potatoes, particular attention was paid to the transmission of mosaic and leaf roll, in which a considerable number of insects were tested, but negative results were obtained with all except the rose aphid, *Macrosiphum solanifolii*. The russet dwarf type of mosaic has been found in Idaho during the present season. Leaf roll has also occurred, and it has been learned that it is carried by the pink and green aphid. A new disease of potatoes called witches' broom is reported, and there is said to be some indication that this disease may belong to the so-called virus group. Isolated plantings in different parts of the State were made of seed potatoes, and the data indicate that seed lots which are most free from the virus group of diseases are those which have been grown in isolated settlements for a number of years without chance for contamination from introduced seed stock. In an experiment on the control of potato scab, inoculated sulfur did not give results to warrant its extensive use.

Extensive experiments were carried on with wheat and oats for the control of smut, in which various brands of copper carbonate, formaldehyde, copper sulfate, furfural, and various mercury compounds were tested. In general it was found that 3 oz. of copper carbonate per bushel of wheat gave as good control as the standard copper sulfate treatment. For spring sown wheat, 2 oz. of copper carbonate was found sufficient. Some of the mercury compounds are said to be promising. Of all the treatments tested for oat smut control, only the dip and spray formaldehyde methods gave satisfactory results.

In some experiments for the control of *Rhizoctonia* on potatoes, presprinkling the tubers and keeping them moist for from 24 to 48 hours was found to increase the control materially. The best control was obtained with Dupont dust No. 15. All the others proved less efficient than corrosive sublimate (1-1,000) presprinkled and formaldehyde (1-120 for 4 minutes' immersion).

For the control of tomato blight, tests were made of the resistance of a number of varieties, and some new selections are proving quite promising.

The bean disease investigations included a study of the fungus disease known as dry root rot of beans, caused by a species of *Fusarium*, and a test of the resistance of the variety Robust to mosaic.

The eelworm disease of clover and alfalfa was found in two counties of the State in 1924, and head smut of corn and stalk smut of rye were reported for the first time.

[Report of Washington Station] division of plant pathology, F. D. HEALD ET AL. (*Washington Col. Sta. Bul. 187 (1924), pp. 66-74*).—The wheat smut

investigations were continued, and the comparative value of copper carbonate and copper sulfate for seedings at different dates was tested. For heavily smutted seed, copper sulfate gave better protection for most of the dates, while with clean seed about equal protection was afforded by either copper sulfate or copper carbonate. Early seeding and very late seeding reduced the amount of smut. An attempt was made to determine the effect of soil fertility on the percentage of smut, but neither nitrate fertilizers nor barnyard manure had any appreciable effect, although there was a marked decrease in smut in crops grown in soils of low fertility. In tests of dust fungicides for the control of bunt in fall seedings, the best copper carbonate treatment was not quite equal to the standard copper sulfate, though both were much superior to the formaldehyde treatment. In general, the best seed treatment gave unsatisfactory results for fall seeded grain when conditions for high infection prevailed. A report is given on the relative value of a number of commercial and other compounds for the prevention of smut in spring seedings.

B. F. Dana reports studies of Rhizoctonia and other diseases of potatoes in which various forms of mosaic diseases have been isolated. The mosaic complexes in Washington are said not to agree in character with the published descriptions of these diseases in other localities. For the control of these diseases, the author found that the tuber indexing did not entirely eliminate spindle tuber and witches' broom, although the method of selection did reduce the amount of these diseases present. Witches' broom is apparently infectious and readily transmitted through the tuber.

The western blight or yellows of tomatoes was studied by the same author. Experiments with scions taken from plants in different stages of the disease showed that the infection was transmitted to the stock if the scion was infectious even to a slight degree.

L. W. Boyle reported on Fusarium rot of onions, the symptoms of which are said to be similar to those caused by Fusarium species in general. The rot of the bulbs in Washington is considered due primarily to species of Fusarium, and the bacterial rot accompanying it is considered secondary.

Additional investigations on the foot rot of wheat, which has been attributed to *Wojnowicia graminis*, are said to indicate that this disease is not one that is likely to become a serious factor in wheat production.

In connection with investigations of winter injury of fruit crops, F. D. Heald reports that a survey of Spokane Valley showed that apple orchards had suffered severe injury. All varieties were affected, but Wagener seemed to suffer more than others. Observations are said to have shown a fairly common occurrence of silvered foliage, such as is characteristic of the silver-leaf disease due to *Stereum purpureum*. The studies of the author, however, have led to the conclusion that the silver-leaf fungus did not make its appearance suddenly but had been prevalent for a number of years in the State, and it must be considered an important wound parasite that will greatly increase the damage in winter injured trees.

Report of the Dominion botanist for the year 1922, H. T. GÜSSOW ET AL. (*Canada Expt. Farms, Div. Bot. Rpt. 1922, pp. 74, figs. 11*).—"The present report furnishes an account of the work done by the members of the staff of the Central Laboratory, Ottawa, including such phases of work as relate to plant disease investigations carried on under the Destructive Insect and Pest Act appropriation, as well as the reports from officers in charge of the branch laboratories."

Report of the Dominion botanist for the year 1923, H. T. GÜSSOW ET AL. (*Canada Expt. Farms, Div. Bot. Rpt. 1923, pp. 55, figs. 10*).—The main lines of

work carried on at the Ottawa Central Laboratory and other laboratories, including the Dominion plant disease survey, economic and general botany, forest pathology, nitroculture distribution, flax wilt, potato inspection and certification, and tobacco diseases, are set forth.

Silver-leaf disease, IV, F. T. BROOKS and H. H. STOREY (*Jour. Pomol. and Hort. Sci.*, 3 (1923), No. 3, pp. 117-141).—This paper is an account of the results of investigations continued (*E. S. R.*, 42, p. 845) on silver-leaf disease since 1919, with some account of work by other investigators.

Some additional hosts for the silver-leaf fungus (*Stereum purpureum*) are mentioned, including certain roses and pears. Attention is directed also to attacks on peaches (under glass), Morello cherries, and apple varieties. Outbreaks, amounting almost to epidemics, on apple and plum, are ascribed to previous careless treatment of trees. Silver-leaf occurrence in nurseries is discussed as to critical times for infection. The influence of type is considered as to susceptibility in Victoria plum. Certain plum stocks prove to be more susceptible than others.

Arguments from pathogenicity are advanced against the separation of *S. rugosiusculum* from *S. purpureum*. The preference of *S. purpureum* for woody tissues not yet invaded by other organisms is pointed out, and the effects of this fungus are described.

One of the chief recovery factors in silvered fruit trees is the formation of a gummy substance impermeable to the fungus and tending to limit its activity.

S. purpureum readily infects newly exposed woody tissue not less than one year old. Pruning wounds are invaded chiefly by fungi of different kinds.

The best protection has been given by gas tar, which does not injure the bark if carefully applied. Information is presented as to the longevity of the spores of *S. purpureum* under different conditions, and as to the toxicity of various substances to the fungus in culture. Silvered plum leaves photosynthesize, but less actively than healthy leaves. Translocation of carbohydrates from silvered leaves proceeds more slowly than from healthy leaves, and silvered leaves also wilt more readily than do healthy leaves. The attempt to differentiate "true" from "false" silver-leaf is considered to be invalid.

There is no known cure for silver-leaf, though good cultivation and manuring may facilitate natural recovery. The disease can be prevented in great measure by the destruction of dead wood which might develop *S. purpureum*, by thinning and pruning cautiously, and by covering exposed tissues immediately with some antiseptic, as gas tar.

A bacterial leafspot of Martynia, C. ELLIOTT (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 10, pp. 483-490, pls. 3).—A description is given of a bacterial disease found on leaves of *M. louisiana* growing in a beet field in Kansas. Attempts were made to transfer the organism to a number of other host plants but without success. A technical description is given of the causal organism, which is given the name *Bacterium martyniae* n. sp.

The influence of time of maturation of wheat on the development of Puccinia graminis [trans. title], J. BEAUVERIE (*Bul. Soc. Path. Vég. France*, 9 (1922), No. 4, pp. 255, 256).—Wheat after sugar beets, and supplied with 40 tons of manure, 400 kg. of superphosphate, 400 kg. of sylvinite, and 100 kg. of nitrate per hectare, showed advanced maturity and almost no rust; whereas wheat after sainfoin, supplied with the same fertilizers minus the farm manure and plus 80 kg. of cyanamide, showed considerably retarded maturity and heavy infection with *P. graminis*.

Further studies on the relation of onion scale pigmentation to disease resistance, J. C. WALKER and C. C. LINDEGREN (*Jour. Agr. Research [U. S.]*,

29 (1924), No. 10, pp. 507-514).—In continuation of investigations of onion smudge (E. S. R., 49, p. 843), the authors give a report of studies made to determine the effect of the soluble toxins occurring in the bulb scales on fungi other than *Colletotrichum circinans*. About a dozen species of organisms which attack the onion bulb were tested, and, with the exception of *Aspergillus niger*, the organisms grew quite as well in the extracts from the dry outer white scales as in the control, but when extracts from colored scales were used germination and growth were either retarded or entirely inhibited. *A. niger*, which normally attacks the outer scales, seemed to be little affected by the outer scale toxins.

A serious potato disease [trans. title], C. CRÉPIN (*Bul. Soc. Path. Vég. France*, 9 (1922), No. 4, pp. 237-243, figs. 2).—In a number of potato fields near the foot of the Forez Mountains in the Department of Loire, France, the author observed a rolling and drying-out of potato leaves, apparently related to some basal or underground trouble. On examination this was found to be associated with the tuber disease ascribed by Ducomet to *Vermicularia varians* (E. S. R., 22, p. 742).

Potato dartoise in 1922 [trans. title], E. FOEX (*Bul. Soc. Path. Vég. France*, 9 (1922), No. 4, pp. 244-250).—A review is given of information available as furnished by different authors regarding potato dartoise, which is said to be widely distributed in France, and to be serious on account of its effects in lowering both quantity and quality of the potato crops.

Dartoise (*Vermicularia varians*) and silver scab (*Spondylocladium atrovirens*) of potato tubers [trans. title], C. CRÉPIN (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 1, pp. 63-66, pls. 2).—The potato disease formerly described under the name dartoise by Ducomet as due to *V. varians* n. sp. (E. S. R., 22, p. 742) and the disease caused by *S. atrovirens*, producing often on the same tubers analogous symptoms, are described as regards certain characters, mostly microscopic.

Potato wilt and filosity [trans. title], C. PERRET (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 163-171).—A premature drying out of potato stems observed in 1922 is attributed to the presence of *Vermicularia varians*, which was found in the great majority of fields affected. The main object of this note is to discuss the relation between the presence of dartoise on the tubers and the wilting of the stalk, drawing attention chiefly to abnormal tuber sprouting, of which an account is given.

Dartoise of potato and its consequences [trans. title], D. S. CAVADAS (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 1, pp. 67-75, pls. 2).—This trouble is here dealt with as regards the morphology of the fungus in different nutrients and the consequences of parasitism. The alterations noted are very prejudicial economically. The sclerotia and the chlamydospores are very persistent, and through them the disease may be conserved indefinitely. Formal treatment of the soil for the destruction of the chlamydospores is said to be very expensive. Methods employing heat also keep down *Fusarium* and other soil-borne diseases.

The biology of *Vermicularia varians* [trans. title], D. CAVADAS (*Rev. Path. Vég. et Ent. Agr.*, 10 (1923), No. 2, pp. 133-140).—Experimentation reported here is said to be more recent than that at the base of the report above noted and to deal with phenomena analogous to those described by Crépin (see above). Both microchemical and micrographical study of the phenomena suggesting leaf roll or necrosis failed to bear out the hypothesis regarding such a character. The symptoms are described.

Tolerance and resistance to the sugar cane mosaic, C. W. EDGEERTON and W. G. TAGGART (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 10, pp. 501-506,

pl. 1).—A report is given of a study of a number of varieties of sugar cane to test the resistance to mosaic when grown under Louisiana conditions. The investigation has shown that resistant Purple canes can be selected in fields with a 100 per cent infection. This is not considered due to slight variations of the host, nor is it known whether the plant is gradually acquiring an immunity somewhat similar to acquired immunity in man and animals. There is said to be some evidence that resistant strains are being developed naturally in some sections of Louisiana, and by discarding the susceptible and selecting the most tolerant canes for seed, it is thought that it will be possible to develop varieties tolerant to mosaic in a much shorter time than if natural selection is allowed to take its course.

Tests of fungicides on apple trees.—II, An analytical study of their effects on the trees, N. H. GRUBB (*Jour. Pomol. and Hort. Sci.*, 3 (1924), No. 4, pp. 157-173).—In experimentation in progress at the East Malling Research Station since 1919, all fungicides tested reduced scab (*Venturia inaequalis*). Bordeaux mixture (6-20-100) controlled scab almost as effectively as lime sulfur (1:59) and more so than ammonium polysulfide. Of the fungicides used, Bordeaux (6-20-100) was least effective against apple mildew (*Podosphaera leucotricha*). Lime sulfur was somewhat more effective than a new brand of ammonium polysulfide. The fungicides used in 1920 clearly reduced the number of canker (*Nectria ditissima*) infections of Worcester Pearmain and James Grieve in the winter of 1920-21. Bordeaux caused considerable russetting. Lime sulfur used as a summer fungicide repeatedly caused heavy fruit drop in all varieties. This was much heavier from leader tipped than from untipped trees.

The effect of fungicides is not confined to the season of their application, being apparent in one case even three years later. The influence of fungicides on the size of the fruit has not been determined. An increased formation of fruit buds following lime sulfur may be only a natural sequence from the resulting fruit drop. Vigor of growth, as measured by weight of prunings, appears in nearly all cases to be increased by the use of the fungicides Bordeaux mixture and lime sulfur.

Monilia blossom blight (brown rot) of apricots, B. A. RUDOLPH (*California Sta. Bul.* 383 (1925), pp. 3-55, figs. 10).—The results are given of an extensive study of a blossom blight of apricots which is due to an imperfect form of *Sclerotinia* commonly referred to in American literature as *S. cinerea*. The perfect form of the fungus is said to grow but rarely in California. The *Monilia* form attacks the blossoms at about the time they are unfolding and having killed the blossoms passes to the twigs, destroying them. Later, the ripening fruit may be attacked, producing the well-known brown rot.

A large number of treatments for the control of the blossom blight were tested, and it was found very difficult to control it in badly infested orchards which are favorably situated for the development of the disease. Orchard sanitation, together with timely spraying, seemed to offer promise. Home-made Bordeaux mixture 8-8-50 gave the best control, though more dilute solutions may give good results where infection is less severe and climatic conditions are favorable for control. Sulfur-containing compounds are not recommended as the author reports they injure apricot trees. Oil emulsions as dormant sprays had some fungicidal value but not sufficient for the control of the disease in humid localities. Fungicidal dusts were ineffective in localities favorable for the growth of the fungus.

A bibliography of 103 titles is given.

Mildew control during 1921 [trans. title], H. FAES, P. TONDUZ, and M. STAEHELIN (*Ann. Agr. Suisse*, 23 (1922), No. 2, pp. 217-230, fig. 1).—Conditions

during 1921 did not greatly favor mildew outbreaks. Compared with copper applications, copperless sprays proved to be very inferior as regards fungicidal effects. A slight addition of casein (50 gm. per hectoliter of copper spray) gave a considerable degree of adhesiveness to the liquid. Copper in colloidal form gave results justifying its further trial.

[Contributions to the study of grape white rot (*Coniothyrium diplo-diella*)]. H. FAES and M. STAEHELIN (*Ann. Agr. Suisse*, 23 (1922), No. 2, pp. 189–202, figs. 7; 24 (1923), Nos. 1, pp. 19–28, figs. 2; 3, pp. 339–348).—The progress of grape white rot since 1878 is outlined, as are also the life history and activities of the causal fungus, designated since about 1884 as *C. diplo-diella*.

Spores of white rot, borne on old material, can infect the crop of the following year. The organism appears to act as a wound parasite, greatly favored by injuries caused by hail, tools, or animals. Injury is greatly increased by repeated hailstorms.

Spores retain germinability for at least two years. Development is related to a sufficiency of sugar in the berry and a moderately high temperature. This explains why this disease attains importance usually between late July and early September. Low temperatures retard the formation of pycnidia. Humidity plays a secondary part in the development of this fungus.

Inadequate results have followed the application of treatments to the berries directly. Alkaline bisulfites, sodium hyposulfites, and formalin, each used in connection with soap, gave the best results, though these proved injurious to the grapes in the concentrations employed.

White rot spores were found to retain germinability for at least three years, with vitality but little impaired, in tests running from 1920 to 1923.

Under the existing climatic conditions, the areas subject to hail and cultivating the grape variety Chasselas, pruned low, suffer most from white rot. The 1923 treatments gave unsatisfactory results. Most of the fungicidal applications caused serious burning but gave inadequate protection.

Fungous and non-infectious troubles of ornamental trees, G. P. CLINTON (*Connecticut State Sta. Bul.* 263 (1924), pp. 171–192).—Descriptions are given of a number of diseases and other injuries to which ornamental trees are subject, the data considered being noninfectious troubles, which include winter injuries, drought and heat injury, smoke and gas injury, spray injury, electric wiring and lightning injury, mechanical injury, etc. This is followed by a description of a considerable number of fungus diseases.

The diagnosis of decay in wood, E. E. HUBERT (*Jour. Agr. Research* [U. S.], 29 (1924), No. 11, pp. 523–567, pls. 11, figs. 6).—The author claims that formerly the identification of the cause of timber rot was usually dependent upon the presence of fruiting bodies of the fungus. From a study of about 1,500 laboratory samples of woods, the author has described a method based upon gross, microscopical, and cultural characters, by which it is possible to recognize the causal organisms responsible for various decays, stains, etc.

ECONOMIC ZOOLOGY—ENTOMOLOGY

Some further facts relative to the principles underlying the making and use of nicotine dust, T. J. HEADLEE and W. RUDOLFS (*New Jersey Stas. Bul.* 400 (1924), pp. 3–44, figs. 20).—This is a report of investigations conducted during 1923, in continuation of the work reported in Bulletin 381 (E. S. R., 50, p. 254). Tests were made of the evolution of nicotine gas from nicotine dusts, under field conditions, for control of the pea aphid. It was found that at a temperature of 70° F., or above, free nicotine-dolomite dust, even when

applied at the rate of 50 lbs. per acre, evolves practically all of its nicotine in 6 hours.

"The great bulk of this nicotine escapes in the first 3 hours, and there is practically none left after the first 9 hours. A temperature of 70° or above is necessary for rapid evolution of nicotine gas from this type of nicotine dust. The employment of nicotine dusts of this character at a temperature of 60° is largely useless, and at a temperature of 50° is a pure waste of time and money. Variation in the size of particles composing a crystalloid carrier of nicotine dust, ranging from 80-mesh to 270-mesh, has comparatively little influence on evolution, but the gas escapes more rapidly from the coarse material. The ordinary 100-mesh dolomite gives somewhere near the average evolution. Thickness of the film of nicotine on the particle makes a difference in the rate of nicotine gas evolution, and within limits thinner films give off gas more rapidly. The rate of nicotine gas evolution varies directly with the temperature and seems in accordance with the well-known principles governing the evaporation of water, but is modified by the presence of nicotine and various impurities in the nicotine solution used.

"The percentage of kill and percentage of reduction vary with the rate of evolution of nicotine gas. A quick release of nicotine gas giving a very high concentration is probably more effective in the percentage of reduction accomplished than a relatively slower but longer continued discharge where the same amount of total nicotine is concerned. The use of higher-content dusts, when the rate of nicotine gas evolution is approximately constant, is likely to be followed by a higher percentage of kill and a higher percentage of reduction, because the charge in the atmosphere about the insect is greater. The practical reduction is much better when the dust is applied before the lice reach a stage of heavy infestation, because a much longer time is required for the percentage of insects which escape destruction to multiply sufficiently to reach numbers serious to the crop. In New Jersey the problem of controlling the pea louse is to be met by destroying 90 to 95 per cent of the lice shortly after they reach an average of 50 individuals to 10 ft. of pea row."

Sodium fluoride as an insecticide; its possibilities as a locust poison, L. B. RIPLEY (*Bul. Ent. Research*, 15 (1924), No. 1, pp. 29-34).—The author reports investigations made of sodium fluoride as a stomach poison, which indicate that it may, in a number of cases, replace the use of arsenical poisons. He finds that, while effective, it is not so toxic as arsenite of soda to either cutworms or the brown locust. Grass or horse dung treated with a 2 per cent solution of sodium fluoride gave good results against adult locusts in the laboratory. Bait treated with a 1 per cent solution was effective against cutworms (*Euxoa* spp.) in the laboratory. Sodium fluoride is not repellent to cutworms, arsenite of soda is highly repellent, and Paris green repels to a lesser extent. Sodium fluoride dust probably does not act as a contact poison on adult locusts, or, if it does, strengths much stronger than 1:20 are required.

Sodium fluoride is considerably less toxic to higher animals than arsenite of soda. In the author's opinion, it should be investigated further as a promising substitute for arsenicals against various insects. Reference is made to investigations of Fulton (*E. S. R.*, 52, p. 253), who has found sodium fluoride to be as effective as white arsenic, with quicker action, when used against the European earwig.

Spray stimulation, F. B. HERBERT (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 567-572, pl. 1).—It has been found that, while stimulation of deciduous fruit trees results from the use of a number of different sprays, the greatest

amount has occurred after using the heavy types of miscible oils. The stimulation is due partly to the heavy oil base and partly to the emulsifiers in them. The condition of the tree and soil and the time of spraying are factors in the amount of stimulation to be obtained from the oil spray. The spray must be applied between December 15 and February 1 to be certain of this effect. Although there may be some disadvantages, the advantages from spraying, particularly to prune, apricot, and cherry growers, include the following: (1) Early bloom, which causes the fruit to set early before the thrips appear, thereby insuring more and cleaner fruit, (2) the early formation of large green leaves, which cover the small fruit, protecting it from sunburn and frost, (3) the attainment of much of the growth of the fruit before the natural moisture has evaporated from the ground, (4) proper functioning of the tree, resulting in larger crops and larger fruit, and (5) earlier harvest, the fruit thereby reaching the market in time for better prices.

Entomology [at the Idaho Station] (*Idaho Sta. Bul. 135* (1925), pp. 28, 29, 32).—Experimental work with the alfalfa weevil during the year indicates that a single spray application is sufficient to obtain satisfactory control. Dusting experiments indicate that where calcium arsenate is used with sulfur or Mab sand the results compare favorably with those obtained by spraying. The imported parasite *Bathyplectes curculionis* was about four times more numerous in the southwest of Idaho than in the preceding year, in a few instances parasitism reaching as high as 25 per cent.

The clover-leaf weevil was found to be doing serious injury to Ladina clover. The first outbreak of the Colorado potato beetle in commercial potato growing districts of south Idaho was discovered during the year. The infestation, however, was limited to a single field, and an attempt was made to eradicate the pest. In control work with the fruit-tree leaf-roller it was found that the egg masses could be killed by using several of the commercial oil emulsions and homemade preparations. Of the commercial preparations Dormoil gave the best results, while with the homemade mixtures the best results were obtained with Diamond paraffin potash fish oil soap oil emulsion. In combating the snowy tree cricket in prune orchards almost complete eradication was secured by a single application of calcium arsenate dust or lead arsenate spray, at a cost for poison materials of \$3 to \$6 per 100 trees.

[Report of the Washington Station] division of entomology, A. L. MELANDER ET AL. (*Washington Col. Sta. Bul. 187* (1924), pp. 46-51).—Work with the orchard leaf roller (E. S. R., 48, p. 553) is first reported upon. Lubricating oil sprays averaged more than 95 per cent destruction of the eggs. The lighter oils proved better than those of medium or heavy viscosity, and killed as high as 98.8 per cent. The proprietary oil sprays gave variable control, several being effective while others gave poor results. Three applications of lead arsenate led to the conclusion that it can not be depended upon for control of the leaf roller, since much of the injury by the caterpillars is done before the spray becomes effective.

A brief reference is made to oil sprays (E. S. R., 52, p. 656).

Laboratory tests of various volatile poisons for the control of subterranean insects, conducted with the view to determining the amount required to saturate a given quantity of soil and the subsequent rate of killing of buried insects, are briefly reported. In the tests poison gas was generated by passing air through the poison, and the air was then drawn, by means of an aspirator, through a glass cylinder of soil, at the exit of which was placed some bean weevils for a living indicator and a jar of absorbing reagent for a chemical indicator. When slowly passed through the series of tubes the poison vapor

would first be taken up by the soil, and after the saturation point was reached would show on the two indicators. Carbon disulfide was found to take only half as long to saturate the soil as did carbon tetrachloride. With calcium cyanide a silver nitrate indicator showed emergence of gas in three or four minutes, and the weevils were dead in 28 minutes. At Toppenish, where wireworms were particularly destructive, single rows of seed, like peas or corn, were drilled into the ground early in the spring. When the seeds sprouted they attracted the wireworms, whereupon granulated calcium cyanide was drilled over the rows of seeds, and was astonishingly effective.

Brief reference is made to a crop pest survey of the State. Several destructive insects are recorded as newcomers to the State, including the asparagus beetle, discovered in the Yakima Valley; the squash bug, which has obtained a foothold near the mouth of the White Salmon River; Bruce's measuring worm (*Rachela bruceata*), known in British Columbia but now occurring in the Okanogan Valley; the satin moth (*Stilpnotia salicis*), which is already as destructive to willow and poplar in Whatcom County as it is in the quarantined district in Massachusetts; the cherry fruit-fly, rapidly spreading in the Palouse section; the cherry sawfly (*Hoplocampa cookei*), which has extended its range northward and is now reported from several localities in western Washington; the lilac miner (*Gracillaria syringella*), a minute European moth that is ruinous to lilac and privet in many cities of western Washington; and the European earwig (*Forficula auricularia*). Brief reference is also made to a number of the insects most destructive during the year.

Proceedings of the Acadian Entomological Society for 1923 (*Acadian Ent. Soc. Proc.*, No. 9 (1923), pp. 72, pls. 6).—Papers presented in this annual report (E. S. R., 50, p. 844) include the following: Spraying in Relation to the Renovation of Old Orchards in New Brunswick, by G. P. Walker (pp. 8-13); Studies on a New Species of *Empusa* Parasitic on the Green Apple Bug (*Lygus communis* var. *novascotiensis* Knight) in the Annapolis Valley, by A. G. Dustan (pp. 14-36); The Garden Springtail (*Sminthurus hortensis* Fitch) as a Crop Pest, by W. H. Brittain (pp. 37-47); Insects of New Brunswick Injurious to Crops in 1923, by G. P. Walker (pp. 48-54); Insects of the Season 1923 in Nova Scotia, by J. P. Spittal (pp. 55-68); and Notes on *Agriotes mancus* Say, at Dartmouth, N. S., by R. P. Gorham (pp. 69-72).

Under the name *Empusa erupta* n. sp., A. G. Dustan describes and reports studies of the life history and development of a parasitic fungus discovered in 1920, which has caused a gradual decrease of the green apple bug (E. S. R., 37, p. 462) in orchards of Annapolis Valley, Nova Scotia. The life of this fungus is comparatively short, probably not extending over more than a month or, at most, six weeks. It is said that bugs, even though severely mutilated by it are still able to move over the foliage quite rapidly. This is due to the fact that the posterior half of the methoracic segment is invaded, and, though the larger wing and leg muscles are destroyed, the muscles of the pro- and meso-thorax are left untouched and the insect is still able to use the first two pairs of legs and the first pair of wings. The retention of the power of locomotion is of great importance is so far as the spread of the disease is concerned. A list of 14 references to the literature consulted is included.

Insect collecting in Panama, D. T. FULLAWAY (*Hawaii. Forester and Agr.*, 21 (1924), No. 3, pp. 94-98).—The author reports that he was able to secure seven different enemies of the pineapple mealybug in Panama, including four species of lady-beetles, two species of flies, and an encyrtid parasite of the

genus *Chrysoplatycerus*. As a general rule the pineapple plants were found to be free of mealybugs, and this was particularly so on the island of Taboga. Attention is called to the fact that the beetle-borer is a very severe pest in Central and South America and the West Indies, and that it must be kept out of Hawaii if the pineapple industry is to continue to flourish.

Work of the division of entomology, E. JARVIS (*Queensland Bur. Sugar Expt. Stas. Ann. Rpt.*, 23 (1923), pp. 47-51).—This report (E. S. R., 49, p. 758) deals particularly with the effect of paradichlorobenzene on cane attacked by the gray-back cockchafer beetle (*Lepidoderma albohirtum* Waterh.), an account of which has been noted (E. S. R., 50, p. 457). Brief references are made to the introduction of scoliid wasp parasites; the influence of chemotropism on cane beetles; injury from moth-borers including the large moth-borer (*Phragmatiphila truncata* Wlk.), the small moth-borer (*Polyocha* sp.), and an unidentified tineid moth-borer; the liberation of tachinid fly parasites; cane damaged by the army worm; and the heavy mortality among cane beetles resulting from climatic control.

Report by the Government entomologist, H. W. SIMMONDS (*Fiji Dept. Agr. Ann. Rpt.* 1922, pp. 3-5).—This report contains a brief account of the insects attacking coconuts, bananas, cotton, etc., during the year. Of particular importance was the discovery early in the year that the coconut scale *Aspidiotus destructor* had reached the island of Vanua Levu, where it is established in Bua Province. In June, the pink bollworm was discovered at Nadi, and subsequently found to be present throughout the group. Toward the close of the year the very destructive coconut leaf moth of Viti Levu (*Levuana iridescens*) was found to have spread to the islands of Caqalai and Moturiki in Lomaiviti.

Orchard insects and their control [trans. title], J. C. FAURE (*Prog. Agr. et Vitic. (Ed. l'Est-Centre)*, 45 (1924), Nos. 19, pp. 442-447, pl. 1; 21, pp. 490-496, pl. 1; 23, pp. 539-547, pl. 1).—This paper deals with some of the more important enemies of fruit trees in France, and particularly with means for their control. The insects and their injury are illustrated in colors.

Insect pests and diseases of the Satsuma orange, H. L. DOZIER (*Gulf Coast Citrus Exch. Ed. Bul.* 1 (1924), pp. 103, pl. 1, figs. 75).—This is a summary of information on the more important insect enemies (pp. 6-82) and fungus diseases (pp. 82-94) of the Satsuma orange, with a discussion of spray materials and a spray schedule.

The insect pests of citrus trees in Egypt, W. J. HALL (*Egypt Min. Agr., Tech. and Sci. Serv. Bul.* 45 (1924), pp. IV+30).—In this work the author deals with 12 species of scale insect enemies of citrus trees; 6 other Egyptian scale insects which do not attack citrus trees, although doing so in other countries; and 4 other insects which attack citrus trees in Egypt, including the Mediterranean fruit fly, cotton aphid, *Aphis leguminosae* Theo., and the white fly (*Aleyrodes* sp.). This is followed by an account of fumigation and other control measures and of 11 other pests, chiefly scale insects, likely to be introduced and the precautions taken at the ports of entry. Ten more pests of citrus trees occurring in other parts of the world are briefly referred to. Directions for the preparation of paraffin emulsion are given in an appendix.

Insect pests of cranberries, D. J. CROWLEY (*Washington Col. Sta. Bul.* 187 (1924), pp. 104, 105).—In further work with the fireworm (E. S. R., 51, p. 158), the use of nicotine sulfate at the rate of 1 gal. to 400 gal. of water was found to give much more effective control than when used at a greater dilution. Fish oil soap is considered to be the most satisfactory spreader. On some bogs two applications of nicotine gave effective control, while others required four

and some as many as five sprays. Control by parasites is thought to be the factor involved, since on some bogs crops practically free from fireworm injury were produced where no spray had been applied. The antique tussock moth, which caused considerable damage on many bogs in 1923, appeared on only one bog in 1924.

Some of the principal insects attacking shade trees in Connecticut, W. E. BRITTON (*Connecticut State Sta. Bul.* 263 (1924), pp. 156-170).—Brief summarized accounts are given of the more important insect enemies of shade trees in Connecticut, together with notes on common insecticides.

Ants, bees, and wasps: Their lives, comedies, and tragedies, E. C. ASH (London: Robert Holden & Co., Ltd., [1924], pp. 136, figs. 126).—A brief popular account.

A new long-horned grasshopper damaging coconut palms in New Britain, B. P. UVAROV (*Bul. Ent. Research*, 15 (1924), No. 1, pp. 35, 36, fig. 1).—Under the name *Habetia defoliaria*, the author describes a new grasshopper which has completely defoliated coconut palms at two or three places in New Britain, which lies near New Guinea.

On a new injurious thrips affecting tea in India, R. S. BAGNALL (*Bul. Ent. Research*, 14 (1924), No. 4, p. 455).—Under the name *Dendrothrips bispinosus*, the author describes a new thrips which was found badly damaging tea on an estate near Kotagiri, in the Nilgiri Hills, south India.

On a new cixiid attacking coconut palms (Homopt.), F. MUIR (*Bul. Ent. Research*, 14 (1924), No. 4, p. 456, fig. 1).—This is a contribution from the Hawaiian Sugar Planters' Experiment Station, in which the author describes a new cixiid, *Euryphlepsia cocos*, which attacks coconut palms in the Solomon Islands.

Fumigation with hydrogen cyanide for control of pear psylla, R. L. WEBSTER (*New York State Sta. Bul.* 523 (1924), pp. 3-23, pls. 4, fig. 1).—This is a report of fumigation investigations conducted in four large pear orchards in western New York for the control of the pear psylla, in which the equipment of fumigating tents and methods used were similar to those used in the fumigation of citrus trees in southern California. The gas was generated by the use of sodium cyanide and sulfuric acid in the so-called "cyanofumer."

Under ordinary conditions, where leakage of gas through the tents was not excessive, all stages of the psylla, including the eggs, were killed by the use of the 75 per cent schedule employed in California. The experimental operations were carried on largely during daylight and without severe fumigation injury to foliage. Where damage to foliage occurred, the shade temperature at the time, or immediately following, ran above 80° F.

"Such severe fumigation injury, both to foliage and fruits, occurred on Kieffer trees during 1919 that experimental work had to be abandoned for the remainder of the summer. No such damage occurred during the continued fumigation of a severely infested pear orchard in 1920. The most severe fumigation injury to foliage occurred with trees fumigated at night, but this fumigation was followed by high temperatures the next day. The reinfestation of fumigated trees from other nearby unfumigated trees, or from adjacent woods, where the insects apparently spent the winter, decreased greatly the value of the fumigation work reported in this bulletin. In general, the conditions under which fumigation operations were carried on in New York were quite unfavorable as compared with those encountered in southern California. The New York work was handicapped by the large size and tall growth of pear trees, by continued rains which made consistent fumigation impossible, and by occasional high winds. Although many serious difficulties

were encountered during the experimental work on fumigation, none of these were considered as being insurmountable."

The correct names of the leafhoppers infesting the apple and potato. E. D. BALL (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 594-600).—The author points out that there has been much confusion and misunderstanding with respect to the scientific and common names to be applied to the three species of leafhopper infesting the apple, namely, *Typhlocyba rosae* L., *Empoasca maligna* Walsh, and *E. fabae* Harr. For assistance in determination, keys are presented, one to the insects and another to the injury.

Notes on the biology of *Pseudococcus gahani* Green. L. WILLIAMS (*Ann. Appl. Biol.*, 11 (1924), No. 3-4, pp. 498-502).—This is an account of a mealybug indigenous to the British Isles, which occurs on red Ribes, Ceanothus, Laburnum, and potato tubers. The life period of the two sexes is very extended, ranging from 20 to 24 weeks, the females passing through five stages, while the males pass through six. There is said to be no danger of its becoming an economic pest, owing to its long life period.

The present status of the citrophilus mealybug in southern California. H. M. ARMITAGE (*Citrus Leaves*, 1924, No. 8, pp. 4-6, 9, fig. 1).—This is a review of the present status of *Pseudococcus gahani* Green, which is one of the most important citrus pests in southern California. It is pointed out that more than 500,000 ladybird beetles (*Cryptolaemus montrouzieri* Muls.) are now being reared and liberated monthly in the citrus orchards of southern California.

The European corn borer and the latest methods of control. L. CAESAR (*Ontario Dept. Agr. Circ.* 44 (1924), pp. 8, figs. 7).—A brief practical account of this pest.

The life-history and habits of *Tortrix pronubana* Hb., with special reference to the larval and pupal stages. R. C. FISHER (*Ann. Appl. Biol.*, 11 (1924), No. 3-4, pp. 395-447, pl. 1, figs. 16).—This is a report of studies of the life history of *T. pronubana*, including technical descriptions of its several stages, and of its economic importance, control, parasites, and relation to Dyar's hypothesis.

This lepidopteran has of late caused injury in glasshouses at the Royal Botanic Gardens, Kew, England, where there are two main broods during the year. A series of experiments have shown that, under glass, spraying with nicotine or lead arsenate is effective if applied before and immediately after the eggs hatch. Fumigation with hydrocyanic acid gas was found ineffective against the larvæ. Two hymenopterous parasites, not yet identified, were reared from the larvæ and pupæ, but the percentage of parasitism was extremely low. A list of host plants of *T. pronubana* under glass and in the open is given in an appendix, together with a bibliography of 23 titles.

South African trypaneid Diptera in the collection of the South African Museum. M. BEZZI (*Ann. So. African Mus.*, 19 (1924), pt. 3, pp. 449-577, pls. 4).—This is a synopsis of fruit flies of South Africa of the six subfamilies of Trypaneidae, as follows: Dacinae, in which 1 genus is erected and 11 new forms are described; Adraminae; Ceratitinae, in which 7 genera are erected and 26 new forms described; Schistopterinae, not yet found in South Africa; the aberrant group of Rhabdochaetinae, in which 1 new species is described; and Trypaneinae, in which 1 genus is erected and 38 forms are described as new. Descriptions are given of 180 species of fruit flies recognized.

Further notes on the Ethiopian fruit-flies, with keys to all the known genera and species. M. BEZZI (*Bul. Ent. Research*, 15 (1924), Nos. 1, pp. 73-

118; 2, pp. 121-155).—This paper completes the author's notes of 1920 and earlier (E. S. R., 45, p. 257).

International conference on the control of the olive fly (*Conférence Internationale de Lutte Contre la Mouche de l'Olive*. Madrid: Gráficas Reunidas, S. A., 1923, pp. 162, pls. 3).—This is a report of the proceedings of an international conference held at Madrid in June, 1923. Included in the proceedings are discussions of The Agricultural Importance of *Dacus Oleae* Rossi in Portugal, by A. F. de Seabra (pp. 81-86); Control Work with the Olive Fly in Spain (pp. 87-108) and The Present Status of Natural Control of the Olive Fly by Parasites (pp. 123-128), both by Aguiló; The Results of Some Experiments on Control Measures for the Olive Fly, by P. Carrión (pp. 148-151); and a Report on the Eradication of the Olive Fly in the Province of Tarragona, by J. Valls y Torres (pp. 151-158).

Oscinella frit Linn.: An investigation to determine how far varietal differences may influence infestation of the oat plant, N. CUNLIFFE and J. C. F. FRYER (*Ann. Appl. Biol.*, 11 (1924), No. 3-4, pp. 465-481).—The authors report observations of an infestation of the stem and grain of 12 varieties of oats grown in widely separated localities, where they were subject to the attack of *O. frit*.

"The stem infestation showed an increase of 11 per cent only, 18 days after June 7. The attack on stems 12 in. in length (including blades) and over was only one-third as intense as that on the remaining stems; 20 per cent of the former were rendered incapable of producing panicles; 25 per cent of the hidden buds plus small tillers were destroyed. Infestation away from the growing point averaged 2 per cent. The infestation of the main grain reached 45.9 per cent, against 22.8 per cent for the bosom grain at Oxford, indicating the importance of the time factor."

Certain aspects of the damage to oats by the frit fly, J. C. F. FRYER and J. E. COLLIN (*Ann. Appl. Biol.*, 11 (1924), No. 3-4, pp. 448-464, figs. 3).—This is a report of a study which deals with the attack of the second brood of the frit fly on the oat grain.

The biology of *Anomala kansana* (Scarabaeidae, Coleop.), W. P. HAYES and J. W. MCCOLLOCH (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 589-594, fig. 1).—This contribution from the Kansas Experiment Station deals with the life history and economic importance of this recently described species. It was found to have a one-year life cycle.

Simple methods of rearing wireworms (Elateridae), M. C. LANE (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 578-582).—The author reports upon a few successful and simple methods of rearing one of the most difficult groups of insects with which the economic entomologist has to deal. The studies were confined largely to *Ludius novius* Hys. and *Pheletes occidentalis* Cand.

Preliminary report on the use of calcium cyanide as a soil fumigant for wireworms, R. E. CAMPBELL (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 562-567).—In preliminary pot and field experiments, calcium cyanide used at the rate of from 130 to 400 lbs. per acre showed a decided toxicity for elaterid larvae, and indicated that about 200 lbs. per acre if properly applied would kill 75 per cent or more of the worms.

Life-history studies of the tobacco flea-beetle in the southern cigar-wrapper district, F. S. CHAMBERLIN and J. N. TENHET (*Jour. Agr. Research* [U. S.], 29 (1924), No. 12, pp. 575-584, figs. 7).—This is a report of biological studies conducted by the U. S. D. A. Bureau of Entomology, at Quincy, Fla., from 1918 to 1923, in connection with control work, an account of which has been reported in U. S. D. A. Farmers' Bulletin 1352, previously noted (E. S.

R., 50, p. 56). Brief technical descriptions of the several stages are included, that of the larva being by A. G. Böving.

In the southern cigar-wrapper district the tobacco crop is attacked by the overwintering brood and by two later generations of the tobacco flea-beetle, and there may be two and possibly three additional broods, which so overlap that it is impossible to tell them apart. Overwintering females may deposit as many as 200 eggs in cracks or crevices in the soil near the base of the plant. In the early spring months at Quincy the eggs hatch in about 11 days, whereas in summer about 5 days are required for incubation. The larvae live underground and feed upon the roots of tobacco and other solanaceous plants. The length of the larval stage was found to vary from 41 days in early spring to 11 days in midsummer at Quincy. About 5 days are required for the pupal stage, which is passed in small oval-shaped cells about an inch below the surface of the ground. The adults upon emerging remain near the ground and confine their feeding to the lower tobacco leaves, but in a short time they spread over the entire plant and feed on all parts of the foliage. In addition to tobacco, which is the preferred food plant, other solanaceous plants, both wild and cultivated, are fed upon to a considerable extent, and in the absence of solanaceous plants the beetles feed sparingly upon other wild and cultivated plants. Oviposition commences soon after emergence from hibernation and continues until early fall. The beetle is capable of flying a considerable distance, this being the most important means of dispersion. In the southern cigar-wrapper district hibernation is incomplete.

The tulle billbug, W. B. TURNER (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 528-532).—This is an account of the life history of (*Sphenophorus*) *Calendra discolor* Mann, which sometimes injures small grains in California by eating into the stems near the head.

Poisoning the boll weevil in the Piedmont section of South Carolina, C. B. NICKELS (*South Carolina Sta. Circ.* 33 (1925), pp. 3-39, figs. 8).—Following an introductory account, experiments with calcium arsenate dust conducted on six farms are reported upon (pp. 9-24). The results, summarized in tabular form, show a maximum profit of \$71.20 per acre to have resulted from the application of calcium arsenate dust on a farm at Anderson and a minimum profit of \$11.83 per acre on a farm at Pickens, the average profit for all plats being \$29.85 per acre. It is pointed out, however, that these figures probably do not represent the profit which could be derived from the control of the boll weevil on the average farm in the Piedmont section, because of the fact that, for the tests conducted, fields were selected which would make good crops and in which the boll weevil threatened serious injury.

In tests of the calcium arsenate molasses mixture (pp. 25-34), about seven applications of a mixture of 1 lb. of calcium arsenate, 1 gal. of water, and 1 gal. of molasses were made at weekly intervals, commencing about the middle of June, followed by a spray consisting of 5 lbs. of calcium arsenate, 8 gal. of water, and 2 gal. of molasses when the cotton plants had put on a considerable amount of fruit, usually after August 1. A tabulation of results shows that in two of the experiments the yield of cotton was actually less on the treated than on the untreated plats. In only two experiments was the yield materially greater on the treated plats than on the checks, and even in these two the greater yield can not be attributed to the effects of the poison applications.

In 12 applications of the poison sold under the name of Hill's Mixture, which contains calcium arsenate, molasses, water, and other ingredients, practically the same results were obtained as those from the 1-1-1 calcium arsenate molasses mixture. No profit was secured from the use of the Florida

stripping method in the experiments conducted, the average total cost of the method having been \$1.54 per acre.

The apple bud weevil, *Anthonomus cinctus* Koll., F. R. PETHERBRIDGE and J. W. COWLAND (*Ann. Appl. Biol.*, 11 (1924), No. 3-4, pp. 482-497, pl. 1, figs. 10).—This is a report of studies of a weevil which is very similar to the apple blossom weevil (*A. pomorum*). It is widely distributed on the Continent and occasionally, in certain districts, does serious damage to pear buds, and now and then is found injuring apples. It has not as yet been recorded on pears in England, but was found killing apple buds at Wisbech in 1921 and near Cambridge in 1922, and the adults have also been found in Kent.

"The eggs are laid in apple buds (usually fruit buds) in the autumn, one egg only in each bud. The larva hatches at the end of February and eats out the succulent portion of the bud. It pupates in May and changes to the weevil stage in June. The weevils puncture the leaf stalks, buds, and succulent portion of the shoots."

Descriptions are given of the various stages, and a comparison is made between this species and those closely allied. In the vicinity of Cambridge, a hymenopterous parasite, *Pimpla pomorum*, killed most of the larvae and pupae left on the trees after collecting.

The lesser clover weevil, G. W. UNDERHILL (*Va. State Crop Pest Comm. Quart. Bul.*, 6 (1924), No. 1, pp. 7, figs. 6).—This is an account of the clover bud weevil, based upon studies at the field station located in 1919 and 1920 at Chester and in May, 1921, moved to Smithfield, Va., for the rest of the season. Five internal parasites have been reared from the larvae, namely, *Microbracon mellitor* Say, *Microbracon* n. sp., *Bathyleptes exigua* Grav., *Bassus albicinctus* Ashm., and *Spilochalcis* sp. The eggs of this weevil are also parasitized by *Anaphes iole* Gir., and a fungus disease kills some larvae.

The effect of weevily seed beans upon the bean crop and upon the dissemination of weevils, *Bruchus obtectus* Say and *B. quadrimaculatus* Fab., A. O. LARSON (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 538-548).—Experiments carried on for several years by the U. S. D. A. Bureau of Entomology with the object of determining the influence of the weevily beans and cowpeas on the production of the crop as well as the probability of the infestation of the crop by weevils contained within the planted seeds, have shown that, while the planting of weevily beans reduces the yield, it does not appear to have any bearing on the infestation of the succeeding crop.

Forty-fourth annual report of the Beekeepers' Association of the Province of Ontario, 1923 (*Ontario Dept. Agr., Beekeepers' Assoc. Ann. Rpt.*, 44 (1923), pp. 79).—The papers and reports presented at the annual convention of this association held at Toronto in December, 1923 (*E. S. R.*, 50, p. 57), include the following: Honey, by H. Root (pp. 10-13); Steam-heated Uncapping Equipment, by E. C. Hardie (pp. 18-20); Extracted Honey Production and Care of the Crop, by S. D. House (pp. 20-24); Foundation and Good Combs, by C. B. Gooderham (pp. 24-31); Placing of Foundation in Frames, by E. T. Bainard (pp. 31, 32); Control of Swarming in Out-Apiaries, by J. L. Byer (pp. 33-38); Ontario Honey Producers Cooperative, Limited, by F. W. Krouse (pp. 38-42); Freight Classification, by R. F. Holtermann (pp. 42, 43); Outdoor Wintering, by R. G. Houghton (pp. 44-50); Spring Management of Bees in Southern Ontario, by M. Pettit (pp. 50-54); Comb-honey Production, by H. G. Sibbald (pp. 54-57); Apiary By-products and Their Disposal, by J. Newton (pp. 58-61); Economy in Production, by R. F. Holtermann (pp. 61-63); Honey in Cooking, and Co-operation, by H. Root (pp. 65, 66); Report of the Provincial Apiarist, by F. E. Millen (pp. 66, 67); Apiary Inspection in

Wisconsin, by S. B. Fracker (pp. 68-72); The Alcohol-Formalin Treatment for American Foulbrood, by O. E. Barber (pp. 72-74); and Judging and Grading Extracted Honey, by W. A. Weir (pp. 75-78).

Bee-keeping for beginners, I. H. JACKSON (*London and Bombay: Blackie & Son Ltd.*, 1924, pp. 112, pls. 9, figs. 20).—This is a brief practical account.

Beekeeping in Wisconsin, J. I. HAMBLETON (*Wis. Agr. Col. Ext. Circ.* 174 (1924), pp. 24, figs. 12).—This is a practical account of beekeeping as applied to Wisconsin conditions.

New parasitic Hymenoptera of the subfamily Anteoninae (Bethyridae), F. A. FENTON (*Ohio Jour. Sci.*, 24 (1924), No. 4, pp. 191-194, figs. 4).—A number of dryinid wasps were reared from several species of Cicadellidae and Fulgoridae collected in Iowa in 1923, three of which are described as new under the names *Pseudogonatopus iowensis*, from *Liburnia lutulenta* Van Duzee; *Aphelopus bicolor*, found to parasitize *Erythroneura trifasciata* Say to an extent of 10 per cent; and *Chalcogonatopus nigrus*, from *Scaphoideus* sp., probably *immistus* Say.

A new chalcid attacking bamboo in India (Hymenoptera), J. WATERSTON (*Bul. Ent. Research*, 15 (1924), No. 1, pp. 69-71, figs. 2).—Under the name *Eurytoma chrysothrix* the author describes a new species bred from bamboo in south India.

The preparation and use of colloidal sulfur as a control for red spider, E. R. DE ONG (*Jour. Econ. Ent.*, 17 (1924), No. 5, pp. 533-538).—The toxic properties of two types of colloidal sulfur, prepared (1) by running hydrogen sulfide into a solution of sulfur dioxide and (2) by precipitating lime-sulfur solution with acid, were compared with a 2 per cent lime-sulfur solution containing 0.6 per cent sulfur, and the colloidal solutions proved more effective, especially at low temperatures. It is stated that the addition of 5 lbs. of ground or flowers of sulfur will probably prolong the length of time such solutions will remain effective, both as acaricides and fungicides.

Some parasitic round worms of the rabbit, with descriptions of two new species, A. C. CHANDLER (*U. S. Natl. Mus. Proc.*, 66 (1924), Art. 16, pp. 6, pls. 2).—Under the name *Nematodirus leporis*, the author describes a new species found in the duodenum of the domestic rabbit at Houston, Tex. A brief account is given of *Obeliscus cuniculi* Graybill, described since the original draft of this paper was written.

FOODS—HUMAN NUTRITION

The relation of arginine and histidine to growth, W. C. ROSE and G. J. COX (*Jour. Biol. Chem.*, 61 (1924), No. 3, pp. 747-773, figs. 10).—The literature on the question of the relation of the amino acids arginine and histidine to maintenance and growth is reviewed, and experiments are reported in which comparisons were made of the growth of rats on diets supposedly balanced with respect to all constituents except nitrogen, this being supplied in the form of casein, completely hydrolyzed casein, hydrolyzed casein from which arginine and histidine had been removed by double precipitation with silver sulfate and barium hydroxide, and hydrolyzed casein plus arginine and histidine, respectively.

The animals receiving whole casein grew normally, those receiving hydrolyzed casein grew to maturity but more slowly, and those on the diet containing no arginine nor histidine did not grow and lost weight rapidly. On adding histidine to such a ration there was invariably a prompt resumption of growth at normal rate, but arginine was without effect even when added

in amounts more than equivalent to the sum of the arginine and histidine present in the original casein. The amount of histidine required for maintenance was 0.1 gm. of histidine monochloride per 100 gm. of food, for moderate growth from 0.2 to 0.3 gm., and for normal growth about 0.5 gm. equivalent to 2.5 per cent of the protein, the proportion of histidine normally present in casein.

These results are thought to indicate that histidine is an indispensable component of the diet, but that, contrary to the observations of Ackroyd and Hopkins (E. S. R., 37, p. 265), "arginine and histidine are not mutually interchangeable in metabolism. The experiments have no bearing upon the question of the indispensability of arginine, since it is quite likely that the Kossel-Kutscher method of precipitation does not remove arginine as completely as it does histidine."

The influence of sodium chloride upon the level of blood uric acid, V. J. HARDING, K. D. ALLIN, and H. B. VAN WYCK (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 61-73, fig. 1).—Experiments on the effect of sodium chloride on the uric acid concentration in the blood of several normal women during the latter half of pregnancy are reported and discussed, with particular reference to certain conclusions of Folin, Berglund, and Derick in their recent paper on uric acid (E. S. R., 52, p. 667).

The ingestion of sodium chloride in connection with a diet predominating in protein or carbohydrate was found to lower the level of the blood uric acid and blood serum proteins, to increase the level of sodium chloride in the blood, and to bring about a marked total retention of water and sodium chloride. The decrease in the concentration of uric acid in the blood is attributed to the increased hydration of the blood, with consequent increased elimination of uric acid. On a constant sodium chloride intake but little difference was found in the level of the blood uric acid when on a protein or carbohydrate diet, thus tending to disprove the theory of Folin and his collaborators that the decrease in the level of the blood uric acid brought about by a high protein diet is due to increased elimination through the kidney.

The urine sugar and its relation to the blood sugar, H. F. HÖST (*Jour. Metabolic Research*, 4 (1923), No. 3-4, pp. 315-414).—In this extensive investigation, various methods of determining carbohydrates in the urine were first studied, and the Benedict-Osterberg method (E. S. R., 39, p. 112) with certain modifications was adopted as the most satisfactory. In this method control of the H-ion concentration was found to be an important factor for accuracy. This was secured in the determination of total carbohydrate by the addition of 4 gm. of sodium bicarbonate to 20 cc. of urine plus 20 cc. of the mercury solution. In the subsequent fermentation the pH value of the urine was brought to between 5.5 and 6.8, after which the urine was brought to boiling temperature, cooled, and 5 per cent of fresh ordinary commercial yeast and glucose to the extent of 1 part per 1,000 added. The reducing substances were determined after 48 hours in the thermostat.

Determinations were then made of the fermentable carbohydrate in the urine in a number of healthy persons, of persons with chronic or intermittent glycosuria, and of diabetics under various conditions of feeding, etc. Blood sugar determinations were also made. In the 7 healthy subjects the total sugar of the urine varied between 450 and 1,320 mg. during the 37 days of the experiment, with an average value of 871 mg. Corresponding figures for fermentable sugars were 180, 710, and 368 mg. The sugar excretion was least in the morning before breakfast, and was in general not altered by the administration of sodium bicarbonate or dilute hydrochloric acid. The blood sugar concentration was likewise not altered by alkali or acid.

Mixed food caused a marked increase in the sugar excretion and some increase in the blood sugar. Of single articles of food, bread caused an increase in sugar excretion which was more pronounced the coarser the bread. The blood sugar showed a greater increase after fine bread than after coarse bread. The maximum blood sugar concentration was always found during the first hour after the meal. A slight increase in sugar excretion resulted in 2 cases after eating 300 gm. of roast meat, but in 4 other experiments with meat, cabbage, and soup there was no increase in sugar excretion. Following the administration of glucose, the amount of blood sugar fluctuated within wide limits without having any effect on the fermentable sugar of the urine. In the 25 healthy persons investigated the fasting blood sugar was less than 110 mg. per 100 cc. Following the ingestion of 50 gm. of glucose dissolved in 200 cc. of water, the amount of blood sugar increased to varying degrees, the greatest concentration being 216 mg. In 6 of the subjects glycosuria occurred after the ingestion of the glucose. The intravenous injection of the same amount of glucose brought about a much more rapid rise in blood sugar.

In the transition cases the difference in the sugar excretion on a carbohydrate-free and carbohydrate-rich diet was very slight when determined on 24-hour samples. In the clinically sugar-free diabetics the amount of fermentable sugar in the urine was about the same as in the case of healthy persons, but with the onset of clinical glycosuria the fermentable sugar of the urine was suddenly increased. Changes in the blood sugar concentration caused by the administration of glucose did not cause any alteration in the excretion of sugar when the renal threshold was not passed. Single articles of food did not produce an increase in the urinary sugar without a simultaneous increase in blood sugar. In quantities of 300 gm., meat caused an increase in the blood sugar concentration in all of the diabetic subjects.

It is stated in conclusion that there are two kinds of sugar excretion in the urine: "(1) Physiological sugar excretion, which has no relation to the amount of glucose in the blood and which comprises sugars whose nature is not known, but which probably do not include glucose. After meals consisting of bread, as well as in urine which is concentrated, these physiological sugars may occur in such quantities that the reduction reactions commonly employed are positive. (2) Pathological sugar excretion caused by the passage of the glucose of the blood into the urine when the blood sugar concentration exceeds the renal threshold."

On the type of sugar excreted in the urine of normal persons, K. TALLERMAN (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 583-585).—To throw some light on the question as to whether the sugar normally circulating in the blood is γ -glucose, an examination was made of the sugar excreted in the urine of normal subjects after phlorhizin injection. It was assumed that since phlorhizin acts only by lowering the threshold value of the kidney for sugar, the sugar excreted in the urine would be of the same nature as that of the blood.

The tests for γ -glucose included reduction of Fehling's solution in the cold and decolorization of potassium permanganate. Negative results were obtained in all cases with the Fehling test, and with the other test there was no greater reduction of potassium permanganate than that produced by any average normal urine. A comparison of the copper-reducing power with the polarimetric reading gave only slight differences, nor was there any appreciable change in the polarimetric reading on standing. Similar results were obtained with the urine of two diabetic patients who had marked glycosuria but were practically free from ketosis.

It is concluded that since no evidence was obtained of the presence of γ -glucose in the urine it is unlikely that this form of sugar is the variety present in normal blood.

Intestinal chemistry, I, II, O. BERGEIM (*Jour. Biol. Chem.*, 62 (1924), No. 1, pp. 45-60).—Two papers are presented.

I. The estimation of intestinal reductions.—In this a new method of determining the reduction taking place in the intestines is described. This consists in the feeding of pure ferric oxide mixed with an equal amount of powdered agar to counteract a tendency to constipation and determining the extent of reduction by fecal analyses for reduced and unreduced iron, care being taken to collect the feces without sufficient exposure to air to cause oxidation.

Preliminary experiments conducted on rats showed that hydrated ferric oxide powder to the extent of 1 per cent of the diet or about one-fourth of this amount of a coarser ferric oxide is sufficient for the determination, the feces being collected for examination after two days on the experimental diet.

II. Intestinal reductions as measures of intestinal putrefaction, with some observations on the influence of diet.—The above method was used to test the reduction in rats of various types of food materials when fed alone and in combination. Analyses of the contents of different parts of the gastrointestinal tract after the feeding of the iron oxide were first made to determine the location of the reducing process. No reduction was found to take place in the stomach, practically none in the upper small intestine, more in the lower small intestine, and by far the largest amount in the cecum and large intestine, the region where intestinal putrefaction of protein predominates.

On starch-protein diets furnishing 20 per cent of protein, the reduction occurred to the greatest extent (71 per cent) with egg albumin, followed by meat (63 per cent), and lowest with casein (19 per cent). On diets containing 20 per cent of egg albumin, 1 per cent of agar, and various carbohydrates to make 100 per cent starch, sucrose, glucose, fructose, and maltose had but little effect in decreasing the reduction brought about by the egg albumin, but dextrin and lactose caused a marked decrease in reduction. Of the other foods tested, fruits and green vegetables alone or as constituents of diets gave moderately low reduction values. Milk when fed alone gave very low reduction values and when fed with other foods decreased the reduction. Several intestinal antiseptics failed to produce any permanent decrease, and intestinal stasis caused marked increase in reduction.

"Intestinal reduction as estimated by the method given is a useful index of intestinal putrefaction and gives additional information as to the degree of anaerobiosis that may exist in the intestine. As the organisms of true putrefaction presumably responsible for the more severe intestinal toxemias are anaerobic in character, the information thus obtained should be of value."

Fat-soluble vitamins.—XVII, The induction of growth-promoting and calcifying properties in a ration by exposure to ultra-violet light, H. STEENBOCK and A. BLACK (*Jour. Biol. Chem.*, 61 (1924), No. 2, pp. 405-422, figs. 10).—In this continuation of the series of studies previously noted (E. S. R., 51, p. 267), the effect upon the growth of young rats of the irradiation of rations containing considerable vitamin A and but little antirachitic vitamin was tested by the usual feeding experiments starting with rats taken at from 21 to 23 days of age and continuing for from 4 to 8 weeks. The ration first used consisted of hog millet 84, casein 12, and salt mixture 4 parts, fed ad libitum. The irradiation consisted in exposure of the material for 10 minutes to the radiations of a quartz mercury vapor lamp in 50-gm. quantities spread

out in thin layers in porcelain dishes. Later a synthetic ration was used, consisting of alcohol-extracted and heated casein 18, salt mixture 4, agar 2, yeast 8, and dextrin 68 parts. In a later experiment this ration was fortified by adding 0.3 per cent of alfalfa. Further modifications consisted in irradiating the ration in Pyrex and quartz flasks and in brown glass bottles in an atmosphere of air and of carbon dioxide. The effect was also tested of heating the irradiated ration for 45 minutes at 96° C. and of letting it stand for 24 hours at room temperature.

The reported growth curves showed consistently that by irradiation the rations could be activated to make them growth-promoting and bone-calcifying to the same degree as when rats were irradiated directly (E. S. R., 50, p. 363). That promotion of growth was due to the antirachitic rather than to the anti-ophthalmic vitamin was shown by the frequent appearance of ophthalmia and respiratory infection while the animals were still growing. Activation to the same degree took place under all the conditions employed except when the ration was exposed in brown bottles.

The statement of Goldblatt and Soames that the livers of irradiated rats are growth-promoting (E. S. R., 50, p. 666) was confirmed, and the same was found to be true of lung and muscle tissue of irradiated rats. The activity of the liver of irradiated rats was not destroyed by drying at 96° for 24 hours and keeping it in the laboratory in a stoppered bottle for 2 months. Inactive muscle and liver, when exposed to irradiations after removal from the body, became activated in growth-promoting and bone-calcifying properties. It is also reported that irradiated olive oil and lard have growth-promoting properties.

Alimentary equilibrium.—Maintenance of the pigeon on a ration totally deprived of vitamin B [trans. title], L. RANDOIN and H. SIMONNET (*Compt. Rend. Acad. Sci. [Paris]*, 179 (1924), No. 15, pp. 700-703, fig. 1).—The authors' theory of the interdependence of vitamin B and carbohydrates has been tested further by a comparison of the weight curves of pigeons fed the synthetic ration previously described (E. S. R., 51, p. 70) with and without vitamin B and a synthetic diet containing no carbohydrates with and without vitamin B.

According to the data presented, maintenance of weight was secured on all the rations except the supposedly complete ration without vitamin B, which resulted in rapid loss in weight followed by death.

The antiscorbutic value of fresh and canned English tomatoes, E. M. DELF (*Biochem. Jour.*, 18 (1924), No. 3-4, pp. 674-678).—With the technique employed in previous studies (E. S. R., 47, p. 568), English tomatoes, fresh and preserved in various ways, were tested for their content of vitamin C, with the following results:

The minimal protective dose for young guinea pigs of the raw fresh juice was between 1.5 and 2.5 cc., an amount somewhat greater than that required for fresh oranges and lemons. It is noted that in similar tests of locally produced South African tomatoes even larger amounts, 4 cc. daily, were necessary.

Commercially canned tomatoes prepared by plunging the fruit in boiling water for 2 minutes, peeling, and processing the peeled fruit without adding water in a water bath gradually heated to 190° F. and kept at that temperature for 45 minutes, were tested after from 4 to 9 months' storage. From 5 to 10 cc. was required for protection.

Of tomatoes canned in the laboratory by plunging into boiling water for 2 minutes, peeling, heating gently for 10 minutes, and then processing in cans at 100° C. for 5 minutes, from 7.5 to 10 cc. were required when fed immediately after canning, while after storage for nearly 4 years 10 cc. was insufficient.

Of canned tomato purée from 5 to 10 cc., equivalent to 15 cc. of the fresh juice, was required.

It is concluded that on canning tomatoes lose nearly three-fourths of their original value as a source of vitamin C, and that this loss is increased on storage.

The nutritive properties of milk.—III, The effectiveness of the X substance in preventing sterility in rats on milk rations high in fat, H. A. MATTILL, J. S. CARMAN, and M. M. CLAYTON (*Jour. Biol. Chem.*, 61 (1924), No. 3, pp. 729-740, figs. 2).—Continuing the investigation previously noted (E. S. R., 49, p. 663), the authors first attempted to determine whether the failure of reproduction in rats on rations whose protein and vitamin content was supplied entirely by whole milk powder to the extent of 50 per cent of the ration was due to a lack of nucleoproteins. The addition of various nucleoprotein supplements did not lead to reproduction, as was noted in a preliminary report (E. S. R., 51, p. 266). Examination of the sexual organs of both males and females showed in the former progressive degeneration of the testes from about 100 days on, which could not be attributed to lack of vitamin B. In the females, ovulation was normal and the failure to reproduce was apparently due to unsuccessful implantation of the uterus.

When the rations were supplemented with from 5 to 10 per cent of wheat embryo, reproduction occurred but the mortality of the young was high. With 5 per cent wheat embryo, third generation animals were obtained. Wheat embryo extracted with ether no longer prevented reproductive failures, thus confirming the conclusion of Evans and Bishop that the substance required for reproduction belongs to the fat-soluble group (E. S. R., 52, p. 262). Further proof that the substance is identical with the vitamin X of Evans and Bishop was the reported success with lettuce leaves as a supplement to the milk diet. In the case of males, fertility was manifest only if the supplement was fed before about the one-hundred-and-fiftieth day of life. The damage wrought by the deficiency could not be overcome beyond that time. Females, however, were quickly restored to fertility after the supplemental feeding.

On a milk diet low in fat marked reproductive failures did not appear, a result confirming the observation of Anderegg (E. S. R., 51, p. 860). "This fact is considered not as evidence against the existence of X, as some have held, but as an indication that the amount of X required for normal reproductive functions depends upon the nature of the diet. Until more information on this relationship and on the natural distribution of X is available, generalizations are unsafe."

The experimental feeding of dried breast milk, L. W. SMITH (*Jour. Biol. Chem.*, 61 (1924), No. 3, pp. 625-631, figs. 4).—A comparative study is reported of the antiscorbutic value of fresh breast milk and breast milk dried by a modification of the Just-Hatmaker roller process and fed freshly dried and after storage for two years. For further comparison, fresh cow's milk, a commercially dried milk (Dryco), and orange juice were also tested. The breast milk was fed in amounts of 60 and 120 cc. or their equivalents, the cow's milk in the amount of 100 cc. or its equivalent, and orange juice 10 cc.

With the smaller amount of the breast milk subnormal growth was obtained, which was less with the dried than with the fresh, and still less with the dried product which had been kept two years. There was, however, no evidence of scurvy in any of the guinea pigs at the end of five weeks. With the larger amount of breast milk normal growth was obtained in the case of the fresh, and slightly subnormal in the case of the dried product. Normal growth

was obtained with the cow's milk, both fresh and dried, and with the orange juice.

It is concluded that "breast milk dried by the method described retains about 80 per cent of its antiscorbutic value when first prepared and about 40 per cent of its original antiscorbutic content after 'aging' for a period of as long as two years."

The muscular efficiency of patients with diabetes mellitus, R. FITZ AND W. P. MURPHY (*Arch. Int. Med.*, 34 (1924), No. 3, pp. 402-415, figs. 4).—Using groups of normal persons as controls, the authors have investigated the muscular efficiency of a number of diabetic patients before treatment had been followed for any length of time, and in a few cases have continued the tests during the period of insulin and dietetic treatment.

The comparison of the normal with the untreated diabetic patients showed that the majority of the latter were considerably weaker than the former, but without specific weakness of any of the special muscle groups tested. The men subjects appeared to be weaker than normal in proportion to their diminished weight and the women to have normal strength in proportion to their body weight. As was shown in a previous paper (E. S. R., 51, p. 366), by correct dietary and insulin treatment the physical strength of diabetic patients can be made to approach normal. The most important single factor in the diet is considered to be the total calories utilized. In the experience of the authors, a considerable time is required to recover strength lost during fasting or severe undernutrition, and for this reason it is considered best to desugarize with insulin rather than with the use of low calorie diets. Charts are given showing the relation between the calories of the diet and the strength of a diabetic patient and the relation between strength and weight in another well-treated diabetic patient.

"The best treatment for a diabetic patient should combine diet and physical exercise, so that as the patient gains weight he gains a more than proportional amount of strength and an increasing strength-weight ratio. Diabetic patients should not be fattened rapidly with insulin and high calorie diets. Such patients do not become as physically efficient as patients who gain weight more gradually on a lower diet and less insulin, and who remain thin but relatively strong, with high strength-weight ratios."

The treatment of diabetes with insulin, W. D. SANSUM, N. R. BLATHERWICK, F. H. SMITH, M. L. LONG, L. C. MAXWELL, E. HILL, R. MCCARTY, and J. H. CRYST (*Jour. Metabolic Research*, 3 (1923), No. 5-6, pp. 641-676).—This report of the methods followed and the results obtained in the first 100 cases of diabetes treated with insulin at the Santa Barbara Cottage Hospital, Santa Barbara, Calif., includes routine diets for use in severe acidosis and to furnish increasing calories from 1,000 to 3,000, tables of the approximate food values of 100-calorie portions of vegetables containing from 3 to 20 per cent carbohydrate and of various other articles of diet, and several recipes for diabetic diets. It is noted that in nearly every case in which the insulin treatment has been continued for a considerable length of time, growth in tolerance has resulted which is greater than in patients under dietetic management alone.

ANIMAL PRODUCTION

On the formulation of methods of experimentation in animal production, E. B. FORBES, H. S. GRINDLEY, ET AL. (*Bul. Natl. Research Council*, 6 (1923), No. 33, pp. 54).—This is a report of the subcommittee on animal nutrition, discussing in detail the methods employed in conducting nutrition

and feeding experiments with animals. The main subdivisions of the bulletin are entitled General Procedure in Animal Experimentation; The Determination of Digestion Coefficients and Nitrogen and Mineral Balances; The Determination of the Total Balance of Matter and Energy, by H. P. Armsby; Feeding Experiments; and References to Literature on Methods and Equipment.

The feeding of productive farm animals, M. KLIMMER (*Fütterungslehre der Landwirtschaftlichen Nutztiere*. Berlin: Paul Parey, 1924, 4. ed., rev. and enl., pp. X+279, figs. 164).—This is another edition of the book previously noted (E. S. R., 46, p. 70). Nearly all parts of the book have been enlarged, while the chapters on vitamins, sweet and sour feeds, and the treatment of straws have been rewritten.

Nutritive value of wheat, J. L. ST. JOHN (*Washington Col. Sta. Bul.* 187 (1924), pp. 36, 37).—In continuing this study (E. S. R., 49, p. 265), the effect of variations in the sodium content of rations of purified food materials has been studied. The preliminary results indicate that variations in the sodium content have a decided effect upon the growth and condition of the animals. Rations low in sodium produced rapid growth for a short time, followed by a decline in weight and in many cases by death. When larger amounts of sodium were included in the purified ration, the animals continued to grow normally and were healthy in appearance.

Stage of maturity of sunflowers for ensilage (*Canada Expt. Farms, Brandon (Man.) Farm Rpt. Supt.* 1923, pp. 39-41).—The desirability and palatability of sunflowers cut at six different stages of growth from the time of forming the heads until 50 per cent of the plants were ripe were compared.

The plants were all allowed to wilt 24 hours before ensiling. All the different cuttings were found to keep perfectly in the silos except for a small wastage on the top of each, but the sunflowers when 60 to 65 per cent in bloom made the most palatable silage, though the palatability of the silage from sunflowers cut when 35 to 37 or 100 per cent in bloom approached it very closely. The silage was least palatable from the most immature sunflowers.

Analyses of the silage made from the sunflowers at the different stages of maturity indicated that the moisture decreased with maturity, while the protein, fat, carbohydrates, and fiber generally increased, the last-named constituent showing a marked increase in the most mature stage.

Trench silo (*Canada Expt. Farms, Brandon (Man.) Farm Rpt. Supt.* 1923, pp. 11, 12, fig. 1).—A very satisfactory report is given of a test of a trench silo. In a trench 30 ft. long, 12 ft. wide, and 8 ft. deep, 45 tons of corn silage were made. Some difficulty from the earthen sides falling in the spring, when the frost came out of the ground, was experienced, however.

Inspection of commercial feedstuffs, P. H. SMITH, F. J. KOKOSKI, ET AL. (*Massachusetts Sta. Control Ser. Bul.* 28 (1924), pp. 35).—This is a report of chemical and microscopical analyses of feeding stuffs inspected in the State during the year ended September 1, 1924 (E. S. R., 50, p. 774).

Feeding stuffs report, 1923, J. W. KELLOGG (*Penn. Dept. Agr. Bul.* 391 (1924), pp. 267).—The guaranteed and found protein, fat, and fiber analyses and the contents as identified microscopically are given for the samples of feeding stuffs officially collected in 1923. The previous report was noted (E. S. R., 51, p. 274).

Studies of the thyroid apparatus.—XI, The effect of thyro-parathyroidectomy on reproduction in the albino rat, F. S. HAMMETT (*Jour. Metabolic Research*, 2 (1922), No. 4, pp. 417-427).—In continuing this series (E. S. R., 48, p. 870), the effect of thyro-parathyroidectomy at 45 and 56 days of age on the reproduction of male and female rats has been investigated. The young

produced were raised to 150 days of age. When no litters occurred from matings 200 days of age, the animals were killed.

Though conception occurred when completely or partially thyroidectomized males and females were mated, and as judged by the development of the secondary sex characters the internal secretions of the gonads were normal, there was an unusually large amount of sterility, late breeding, small litter size, and high mortality of the young at birth, during suckling, and after weaning. These results are concluded to be due to a general lowering of the anabolic level of the organism rather than to any direct effect of the secretions of the gonads of either sex.

Studies of the thyroid apparatus, XIII-XV, F. S. HAMMETT (*Amer. Jour. Anat.*, 32 (1923), No. 1, pp. 37-94).—Three papers are presented in continuation of this series of studies, noted above.

XIII. The effects of thyro-parathyroidectomy and parathyroidectomy at 100 days of age on the growth of the reproductive system of male and female albino rats (pp. 37-51).—In this paper the effect of the removal of the parathyroid or parathyroid and thyroid glands at 100 days of age on the subsequent growth of the reproductive system to 150 days of age was measured by comparing the ovary and uterus weights of females and the testicle and epididymis weights of control rats at the time of the operation with the weights of these organs in the operated animals at 150 days of age.

The effect of the removal of the thyroid apparatus was evidently much greater in females than in males. The ovaries and uterus in operated animals not only stopped growing but actually retrogressed, retrogression being greater in the gonad. In the males the growth of the testicle and epididymis was slightly retarded with the removal of the entire thyroid apparatus, but seemed to be not at all affected by the removal of only the parathyroid glands. The greater sensitiveness of the female reproductive organs to the toxemia created by a lack of the parathyroid gland and a close relationship between the ovary and the thyroid in addition to the control of the thyroid over the metabolic processes is pointed out. On the other hand, the male reproductive system is markedly resistant to the toxemia following parathyroid removal, and the growth of the testicle and epididymis is less retarded than body growth as a whole by the removal of the thyroid apparatus.

XIV. The effects of thyro-parathyroidectomy and parathyroidectomy at 100 days of age on the growth of the glands of internal secretion of male and female albino rats (pp. 53-74).—The removal of the thyroid apparatus at 100 days of age resulted in accelerated growth in the hypophysis of the male and retarded growth in the same gland of the female, and an absolute cessation of growth and a high degree of retrogression in the adrenals, pancreas, and thymus of both sexes, but being somewhat more marked in the females. The thymus was evidently the most dependent on the thyroid secretion for normal development and activity. The author believes that the general action of parathyroidectomy is more attributable to a generalized toxemia than to any specific functional relationships.

XV. The growth of the heart, lungs, liver, kidneys, spleen, submaxillary glands, and eyeballs in male and female albino rats thyro-parathyroidectomized and parathyroidectomized when 100 days of age (pp. 75-94).—The removal of the thyroid tissue at the age of 100 days was found to cause an inhibition and retrogression in the growth of the heart, liver, kidneys, and spleen to 150 days of age. Growth was retarded in the lungs and submaxillary glands, but definite retrogression did not occur.

The removal of the parathyroid gland only resulted in retardation of growth in various glands, probably due to the resulting toxemia. Peculiar effects in

stimulating growth in the spleen and submaxillary gland were apparent. Neither parathyroidectomy nor thyroidectomy affected the growth of the eyeballs in males, and retardation was only slight in females.

How animals use their time on pasture [trans. title], M. ELLINGBØ (*Tidsskr. Norske Landbr.*, 31 (1924), No. 3, pp. 110-125, fig. 1).—The results of a study of the time utilized in foraging and resting by cattle, sheep, and horses on pasture during three separate days are reported. There were found to be considerable variations in the length of the pasturing and the rest periods, but the hours of grazing were definitely increased with cows during the summer, with smaller increases for the other animals. The cows were found to ruminate while resting, but those resting for the shortest periods were the best producers.

The nutritive properties of pinto beans and pinto bean straw and their use as feed for cattle, H. W. TITUS (*New Mexico Sta. Bul.* 143 (1924), pp. 73).—This bulletin reports the results of three digestion experiments with steers.

In the first experiment 5 steers weighing about 500 lbs. at the start were fed a ration averaging 4 lbs. of coarsely ground pinto bean culls and 8.25 lbs. of corn stover cut in inch lengths. The experiment lasted 111 days, during which 3 digestion trials of 10 days in duration were conducted with 4 of the steers. The preliminary periods to the actual digestion trials necessitated keeping the animals in metabolism stalls for 42 days. Notwithstanding this handicap, the steers made average gains of 0.89 lb. per day, consuming an average of 12.21 lbs. of feed per 100 lbs. of gain. The average coefficients of digestibility for the different nutrients of the pinto beans as calculated for the different animals in the three trials are given in the table below. Efforts to make the steers consume more than 4 lbs. of the pinto beans daily failed, the steers soon scouring and going off feed. The impossible digestibility of the ash is pointed out as resulting from the use of too small coefficients for the ash of corn stover. Nitrogen balances were computed during the trials, and it was found that 3 were negative while 9 were positive. No explanation for the negative balances was offered.

The second and third experiments were conducted similarly to the first. Five steers averaging about 500 lbs. in live weight were used in the second experiment, which lasted 98 days. The average daily rations per steer were 11 lbs. 13 oz. of pulled pinto bean straw and 3 lbs. 3 oz. of coarsely ground corn for the first two-thirds of the experiment. During the last third of the experiment the amount of pinto bean straw was reduced 1 oz. per steer daily. The average digestibility of the pinto bean straw as computed is tabulated below. During this experiment the steers, though in metabolism stalls for 46 days, gained an average of 1.21 lbs. per day and consumed 771 lbs. of feed per 100 lbs. of gain. It is pointed out that the pinto bean straw had few leaves and consisted of roots as well as stems and empty pods. There was much residue not eaten, consisting mainly of coarse stems and roots. The nitrogen balances showed that all steers were storing large quantities of nitrogen during each of the experiments.

The six steers used in the third experiment were about 25 lbs. heavier than those used in the first two. The ration fed consisted only of pinto bean straw cut with a mowing machine and therefore of much better quality than that fed in the previous experiments. The amount given the steers was 15 lbs. daily during the digestion trials and the preliminary feeding periods, with 16 lbs. daily during the rest of the experiment. The animals were confined to the metabolism stalls 45 of the 115 days of this experiment and gained an average of 0.89 lb. per day, consuming 1,552 lbs. of feed per 100 lbs. of gain.

The author points out the similarity between the composition of the cut pinto bean straw and alfalfa hay, but from the average digestibility of the former, as appears in the table below, it may be seen that it is not as well utilized by the animal as alfalfa hay. The nitrogen balances of the steers receiving the pinto bean straw showed that nitrogen storage was greater during the first part of the experiment. The analysis of the feeds used and the data employed in calculating the digestibility of the feeds are tabulated in detail in the bulletin. Coefficients of digestibility were determined by the usual method and by the method of least squares. The coefficients determined by the former method follow:

Average digestibility of pinto beans and pinto bean straw

Feed	Coefficient of digestibility						
	Dry matter	Organic matter	Total nitrogen and crude protein	Crude fiber	Ether extract	Nitrogen free extract	Ash
	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
Pinto beans (culls)	68.37	63.31	53.60	Neg.	40.96	84.02	145.76
Pulled pinto bean straw	50.07	53.43	35.61	44.48	22.69	63.76	25.77
Cut pinto bean straw	55.08	60.95	67.41	51.45	29.79	66.94	19.07

Prickly pear as a fodder for cattle (*Mysore Dept. Agr. Circ. 40 (1924), pp. 15, figs. 8*).—This consists of directions for the use of prickly pear as a cattle feed, dealing mainly with the methods of removing the thorns either by pincers or by burning.

Steer feeding [at the Caldwell Substation] (*Idaho Sta. Bul. 135 (1925), pp. 47, 48*).—Five lots of 10 2-year-old steers were used for comparing various rations of alfalfa in a 150-day test as follows: Lot 1, 20.7 lbs. of cut alfalfa hay and 9.7 lbs. of ground barley; lot 2, 23.8 lbs. of alfalfa hay and 9.7 lbs. of ground barley; lot 3, 24.3 lbs. of alfalfa hay and 9.7 lbs. of ground corn; lot 4, 23.4 lbs. of alfalfa hay and 22.5 lbs. of corn silage, and lot 5, 19.8 lbs. of alfalfa hay, 14.3 lbs. of corn silage, and 9.2 lbs. of ground barley.

The average daily gains made by the different lots were, respectively, 1.90, 1.79, 1.85, 1.46, and 2.11 lbs. The calculated costs of the rations and profits per steer are given, as well as the average feed consumption per 100 lbs. of gain by each lot.

Steer feeding experiment, 1922-23 (*Canada Expt. Farms, Brandon (Man.) Farm Rpt. Supt. 1923, pp. 8-10*).—The rates and economy of gains made by 18- and 30-month-old steers were compared in a test lasting 163 days. The feeds used consisted of corn silage, oat straw, and a grain mixture of equal parts of oat chop and ground re-cleaned wheat screenings. During the latter part of the test the grain mixture was modified to consist of one-third barley chop, and mixed hay replaced part of the silage.

The yearlings made average daily gains of 1.24 lbs., as compared with 1.4 lbs. by the 2-year-olds. They also consumed only about two-thirds as much corn silage as the 2-year-olds, but the consumption of other feeds was within 10 per cent of the same. The calculated feed costs were for yearlings \$292.25, and for the 2-year-olds \$369.34. The feed cost of grain was greater for the older steers, but their better finish and greater gains resulted in a much larger profit per animal.

Steer-feeding experiment (*Canada Expt. Farms, Rosthern (Sask.) Sta. Rpt. Supt. 1923, pp. 6, 7*).—Four lots of steers were selected for testing the value of succulent feeds as additions to a ration of oat straw and grain consisting of ground oats at the beginning of the experiment with a gradual change to ground barley toward the end of the test. Lot 1 was composed of 18 2-year-old steers averaging 1,098 lbs. in weight, while the steers in the other lots averaged about 780 lbs. Lots 1 and 2 received sunflower silage, lot 3 received turnips from November 25 to March 15, and sunflower silage to the end of the experiment, and lot 4 received no succulent feeds.

Steers receiving silage throughout the 165 days of the experiment were better finished than those receiving no succulents. Turnip feeding did not produce as good a finish as silage, but the use of silage during the latter part of the feeding period for this lot finished them practically as well as lots 1 and 2. The finish of lot 4 receiving no succulents was decidedly inferior, though the average daily gains of all lots were very similar, varying from 1.87 lbs. for lot 4 to 2.06 lbs. for lot 2.

Herd management [at the Washington Station], H. HACKEDORN and J. SOTOLA (*Washington Col. Sta. Bul. 187 (1924), p. 32*).—Records of the beef breeding herd have shown that cows calving in January and February can be wintered on from 2 to 2.5 tons of silage, 0.75 ton of alfalfa hay, and grain according to the condition of the animal. It is deemed advisable to give grain to cows suckling calves during the winter.

The effect of exercise and feed on the vitality of sperm cells and breeding ability of bulls, E. V. ELLINGTON (*Washington Col. Sta. Bul. 187 (1924), pp. 44, 45*).—This study (*E. S. R.*, 49, p. 275) has been continued by making H-ion determinations of the semen in addition to the microscopic examinations. No relation was found between the H-ion concentration of the semen and the length of life of the sperms. The H-ion concentration of semen was universally lower than the H-ion concentration of the vaginal secretions of cows, but the pH of both showed little variability.

The Southdown sheep, edited by E. WALFORD-LLOYD (*Chichester, Eng.: Advertising Com. Southdown Sheep Soc., 1924, pp. 95, pls. 15, figs. 3*).—This consists of a series of popular articles on the history, characteristics, and management of Southdowns, with special articles on the management and success of the breed in various sections of the world.

Sheep raising in Minnesota, P. A. ANDERSON (*Minn. Univ. Agr. Ext. Spec. Bul. 87 (1924), pp. 12, figs. 4*).—Popular directions for raising sheep.

Observations on range sheep management in New Mexico, H. S. MOLES, J. G. KOGLER, and P. E. NEALE (*N. Mex. Agr. Col. Ext. Circ. 80 (1924), pp. 27, figs. 13*).—This is a popular description of the more accepted practices involved in the range management of sheep under New Mexico conditions.

Relation of sheep to climate, E. L. JOHNSON (*Jour. Agr. Research [U. S.], 29 (1924), No. 10, pp. 491-500, figs. 18*).—The author discusses the variations in the climate of various sections of the world which have been considered well adapted to sheep production. He finds that the densely populated sheep areas have mean temperatures ranging from 28 to 77° F., average monthly rainfall of from 0.3 to 4.5 in., and a relative humidity of from 55 to 70 per cent at the higher temperatures and from 65 to 91 per cent at the lower temperatures. The importance of having favorable conditions during the season of rutting, pregnancy, lambing, and the growth of the lambs is pointed out.

Lambs and wool for market, B. E. CARMICHAEL (*Md. Univ. [Agr.] Ext. Bul. 36 (1924), pp. 35, figs. 17*).—This is a popular discussion of lamb and wool production, with special reference to Maryland conditions.

Lamb feeding [experiments at the Caldwell Substation] (*Idaho Sta. Bul.* 135 (1925), pp. 48, 49).—In this experiment 500 lambs were fed in 7 lots for 100 days. The lambs averaged 60 lbs. at the beginning of the test, and made average daily gains and consumed amounts of feed per 100 lbs. of gain as follows: Lot 1, 0.30 lb. requiring 1,163 lbs. of alfalfa hay, 246 lbs. of barley, and 581 lbs. of corn silage; lot 2, 0.32 lb., requiring 1,221 lbs. of alfalfa hay, 237 lbs. of barley, and 314 lbs. of corn silage; lot 3, 0.30 lb., requiring 1,298 lbs. of alfalfa hay and 243 lbs. of shelled corn; lot 4, 0.29 lb., requiring 1,497 lbs. of alfalfa hay and 266 lbs. of wheat; lot 5, 0.29 lb., requiring 1,225 lbs. of alfalfa hay and 258 lbs. of barley; lot 6, 0.29 lb., requiring 1,041 lbs. of cut alfalfa hay and 256 lbs. of barley; and lot 7, 0.29 lb., requiring 1,318 lbs. of alfalfa hay and 261 lbs. of barley per 100 lbs. gain.

Fat lamb raising (*Queensland Agr. Jour.*, 22 (1924), No. 3, pp. 160, 161).—A brief summary of seven years' lamb raising trials conducted at the Cowra, Wagga, and Bathurst Experiment Farms from 1912 to 1919 is given. The results of individual experiments have been previously noted (*E. S. R.*, 50, p. 271).

The crossbred Border Leicester \times Merino ewes showed to the best advantage as dams, while Dorset Horn rams proved to be the best sires. In the 1922-23 trials at the Bathurst and Cowra Farms excellent returns were realized from Lincoln \times Merino ewes bred to Dorset and Ryeland rams. This was also true of the 1922 trials at the Wagga Farm, in which Dorset Horn and Corriedale rams were crossed with Border Leicester \times Merino ewes.

Experiments with crossbred Charmoise \times Limousin lambs [trans. title], C. VOITELLIER (*Rev. Zootech.* [Paris], 2 (1923), No. 9, pp. 159-174, figs. 9).—Charmoise rams were crossed with Limousin ewes at the Vaulx-de-Cernay Experiment Station for Zootechny. The lambs produced were observed as to their rate of growth, the effect of castration at 15 days of age on the rate of growth, and the carcass yields when slaughtered at 6 months of age.

The general characteristics of the crossbred lambs compared equally with those sired in other experiments by Southdown rams. Castration caused a retardation in the growth, which was not regained at 6 months of age. The dressing percentages of both wether and ram lambs were similar, and thus there was no increase in the net weight as a result of castration.

Recent progress in the wool industries, A. F. BARKER (*Jour. Roy. Soc. Arts*, 72 (1924), No. 3755, pp. 861-869, figs. 5).—A popular lecture on wool production in England.

The Australasian wool trade: Annual review and statistics, season 1923-1924, DALGETY & Co. LTD. (*Dalgety's Ann. Wool Rev. Australasia*, 26 (1924), pp. 139).—This deals with conditions in the wool and mutton markets of Australia, New Zealand, and South Africa during the season 1923-24, as in a previous report (*E. S. R.*, 42, p. 770).

[Swine feeding experiments at the Delaware Station], A. E. TOMHAVE (*Delaware Sta. Bul.* 139 (1925), pp. 12, 13).—The results of two experiments are reported.

Alfalfa hay as a winter feed for brood sows.—Sows wintered on corn and alfalfa hay with a small amount of tankage toward the end of gestation made somewhat greater gains than sows wintered on corn and tankage, and the former ration was much cheaper. The pigs were equally strong and uniform on both rations.

Supplements to corn for growing fattening swine.—In continuing the comparison of tankage and fish meal as supplements to corn for fattening swine

(E. S. R., 51, p. 173), fish meal again proved superior in amount and economy of gains produced. The average daily gains during the 58-day test were 1.65 lbs. per pig for the lot receiving fish meal and 1.05 lbs. for the lot receiving tankage.

Studies in swine nutrition (*Idaho Sta. Bul. 135 (1925), pp. 20, 21*).—In a study of the value of Canadian field peas for pork production, 4 lots of 8 120-lb. pigs were fed for 76 days on the following rations: Lot 1 cracked peas, lot 2 cracked peas and rolled barley (3:7), lot 3 rolled barley and tankage (15:1), and lot 4 cracked corn and tankage (9:1). The average daily gain of all lots was approximately 1.33 lbs. The amounts of feed required per 100 lbs. of gain were, respectively, as follows in the different lots: 378.4, 410.9, 438.3, and 409.5 lbs.

In a second experiment various forages were compared for fattening 44 spring pigs as follows: Lot 1 peas, lot 2 peas and 1 per cent rolled barley, lot 3 alfalfa and 4 per cent of a mixture of rolled barley and tankage (15:1), and lot 4 alfalfa and 4 per cent of a mixture of corn and tankage (12:1). The average daily gains of the four lots during this experiment were 0.95, 1.07, 1.17, and 1.3 lbs., respectively. Following the forage period these pigs were fed for 30 days in dry lot on the following rations: Lot 1 cracked peas, lot 2 cracked peas and rolled barley (7:2), lot 3 rolled barley and tankage (14:1), and lot 4 corn and tankage (10:1). The average daily gains and the feed requirements per 100 lbs. of gain were, respectively, as follows: Lot 1 1.49 and 362.2 lbs., lot 2 1.64 and 393.4 lbs., lot 3 2.02 and 411.3 lbs., and lot 4 2.01 and 414.7 lbs. The melting points and iodine numbers of the back and leaf fat of the hogs in both of the above experiments showed no particular differences according to the rations fed.

In a study of the effect of Canadian field peas on reproduction, 3 lots of 4 gilts averaging about 185 lbs. in weight were fed during a 150-day period, including gestation, on the following rations: Lot 1 a grain mixture of 1.5 parts of peas, 1 part of barley, 1 of oats, 1 of corn, and 1 of wheat, with all the alfalfa meal they would consume; lot 2 a grain mixture of 1 part of peas and 2 parts of barley, with alfalfa meal; and lot 3 peas alone. The average daily gains were slightly less in lot 3, and there was a tendency toward an occasional lack of appetite. The weights of the litters farrowed by this lot were also somewhat less. The results with lots 1 and 2 were practically equal.

Swine investigations [at the Washington Station], R. T. SMITH (*Washington Col. Sta. Bul. 187 (1924), pp. 33, 34*).—Brief results of the following investigations are noted:

Alfalfa or sweet clover followed by peas.—The effect of limited and full rations with alfalfa pasture on the subsequent gains of hogs receiving pea forage has been studied. In two years' work pigs full-fed on alfalfa pasture weighed 15.3 lbs. more at the end of 46 days than limited-fed pigs, but the former groups required 63.9 lbs. more barley, 32 lbs. more millrun, and 15.4 lbs. more tankage per pig. The limited-fed pigs made 0.2 lb. greater average daily gains on peas, and both lots reached market weight (173 lbs.) at the same time.

In one trial sweet clover and alfalfa proved to be of equal value, though the sweet clover stayed green longer during the dry part of the late summer.

The value of yeast for pigs.—Two lots of approximately 75-lb. pigs were fed on a ration of rolled barley and millrun in the proportion of 100 to 25 parts, with 10 parts of tankage. One group received in addition approximately 1 per cent of yeast. At the end of the 62-day feeding period the yeast-fed pigs had a somewhat better coat of hair, but their average daily gains were only

1.09 lbs. as compared with 1.13 lbs. by the other lot. More feed was also required per unit of gain by the yeast-fed pigs.

Winter rations for sows.—In this test the tankage in a ration of barley and alfalfa hay was satisfactorily replaced by millrun. A tankage-fed lot was somewhat sleeker in appearance and made 0.06 lb. greater average daily gains during the experiment.

Cost of keeping brood sows.—One year's records show that a sow consumes as much concentrates during an average nursing period of 76.2 days as during the rest of the year. In nursing pigs 75 per cent of the losses occurred during the first week after farrowing.

Pig feeding experiments (*Canada Expt. Farms, Brandon (Man.) Farm Rpt. Supt. 1923, pp. 12-16, fig. 1*).—The results of several pig feeding experiments are summarized.

Oats v. rape pasture, buttermilk v. tankage on pasture.—Four lots of pigs averaging from 55 to 60 lbs. were used for comparing oats and rape as forage crops and buttermilk and tankage as supplements to a grain mixture of shorts, ground and re-cleaned wheat screenings, and feed flour 3:3:1 in addition to the forage crops. There were 11 pigs in each of three lots and 9 in the other lot. The forage crops were planted in 0.5 acre plats. The grain was fed as a slop mixed with water when tankage was fed or with buttermilk for comparison. The average daily gains were for the lot receiving oats and buttermilk 1.11 lbs., rape and buttermilk 1.21, rape and tankage 0.95, and oats and tankage 0.92 lb. The different methods of feeding had practically no effect on the type of the pigs.

Buttermilk v. tankage without pasture.—Four lots of 8 pigs each, averaging about 55 lbs. in weight, were used for comparing supplements of buttermilk and tankage to a ration consisting of 3 parts of shorts, 3 parts of ground re-cleaned wheat screenings, and 1 part of feed flour fed in dry lot and in small indoor pens. Buttermilk produced better gains in both dry lot and inside feeding, the average per day being, respectively, 1.15 and 1.13 lbs. as compared with 0.79 and 0.87 lb. for lots under similar conditions but receiving tankage in amounts equal to 10 per cent of the grain mixture. The feed consumption was practically the same as by the pigs in the above experiment and, therefore, pasture, dry lot, and indoor feeding are compared. Greater profits were calculated from the feeding with pasture.

Oats v. barley.—Two lots of pigs fed in dry lot and an equal number fed in pens were used for comparing rations consisting mainly of oats and barley. The rations fed to one indoor lot and one lot fed in dry lot were composed of 3 parts of barley chop, 1 part of feed flour, and 1 part of shorts, while the other lot had the barley chop replaced by oat chop. The gains were somewhat greater on the barley ration, averaging 1.27 and 1.15 lbs. per day, as compared with 0.89 and 0.97 lb. for the lots receiving oats.

[Swine feeding experiments] (*Canada Expt. Farms, Rosthern (Sask.) Sta. Rpt. Supt. 1923, pp. 11-16*).—The results of several hog feeding experiments are noted.

Light and heavy feeding on pasture and dry lot.—Six lots of 7 pigs each, averaging about 45 lbs. in weight, were selected for comparing heavy and light feeding on pasture and in dry lot. The heavy feeding consisted of 5 lbs. of grain per 100 lbs. of live weight at the start of the experiment, with a gradual reduction to 4 lbs. of grain per 100 lbs. of live weight near the end of the fattening period. Two lots were fattened on oat pasture, rape pasture, and in dry lot, one receiving a heavy and the other a light ration. With pasture the light ration was one-half the heavy ration and in dry lot two-thirds

the heavy ration. The amounts of pasture allowed were 0.75 acre for the heavy fed lots and 1.5 acres for the light fed lots.

The pigs in the four lots on pasture made very uniform gains, varying from 0.87 to 0.94 lb. per day, but there was less than 3.3 lbs. of grain eaten per pound of gain by the light fed lots, as compared with more than 4 lbs. of grain per pound of gain by the heavy fed pastured lots. The average daily gains of the heavy and light fed pigs in dry lot were 0.85 and 0.75 lb., the grain requirements per pound of gain being 4.25 and 3.89 lbs. The saving in the feed cost of fattening by the use of pasture is pointed out.

Pasture and heavy and light feeding with purebred and crossbred hogs.—The individual weights, grades, and sales returns are given of the pigs used in the above experiment, consisting of purebred Tamworths, Berkshires, and crossbreds between the two breeds in each lot. Better results from pasture were noted in the grades of the pigs throughout, and the largest number of selected pigs consisted of crossbreds in the oat pastured groups. The lots receiving pasture also matured more quickly.

Pasture crops and breed comparison.—Six boars each of the Berkshire and Tamworth breeds, averaging from about 100 to 150 lbs. in weight, were pastured on rape and oats, with the addition of a ration of oats, barley, and shorts fed as a slop. The most rapid gains were made on the oat pasture, but the gains made on rape pasture required slightly less feed.

Self-feeder v. hand-feeding.—Two lots of 11 pigs each, averaging about 50 lbs. in weight, were used for comparing self-feeding and hand-feeding in a 93-day test. The ration consisted of shorts, oats, and barley chop, fed as a slop to one lot and in a self-feeder to the other group. The hogs on the self-feeder made more rapid gains and consumed greater amounts of feed, but the estimated cost per pound of gain was 1.6 cts. less than for the hand-fed hogs. The hand-fed pigs more nearly approached the desirable bacon type at the conclusion of the experiment.

Concerning the question of raising barrows [trans. title], N. A. KRESTOV (*Izv. Opytn. Dona i Sev. Kavkaza (Jour. Agr. Research Don and North Caucasus)*, No. 4 (1924), pp. 62-71, 191).—In the English abstract of this article it is stated that two experiments with weanling pigs were conducted, in which linseed-oil cake was found to be a satisfactory substitute for all or part of the milk in the rations consisting largely of barley.

Selection, care, and management of the boar, R. G. KNOX (*Ontario Dept. Agr. Bul. 307* (1924), pp. 13, figs. 10).—General directions for the care, management, selection, and feeding of boars are given, with tabulated results of two winters' feeding of boars of various ages. The ration employed in each case consisted of a mixture of equal parts of barley and oats, whey, and mangels. The boars made satisfactory gains and were in good breeding condition in all cases.

The feeding of animals by the method of equivalent feeds.—*The feeding of young horses after weaning* [trans. title], A. M. LEROY (*Rev. Zootech. [Paris]*, 2 (1923), No. 9, pp. 207-217, figs. 2).—The use of the graphical method of calculating rations (*E. S. R.*, 50, p. 471) is discussed, with special reference to the rations of colts from weaning to maturity.

Stallion enrollment.—XIII, Report of stallion enrollment work for the year 1924 with lists of stallions and jacks enrolled (*Indiana Sta. Circ. 120* (1924), pp. 48).—As in previous reports (*E. S. R.*, 51, p. 376), this consists largely of a directory of enrollments and renewals of stallions and jacks standing for service in Indiana during the calendar year 1924.

[*Experiments with poultry at the Idaho Station*] (*Idaho Sta. Bul. 135* (1925), pp. 39-42).—The results of experiments with poultry are briefly noted.

Poultry breeding investigations (pp. 39, 40).—By careful breeding the egg production of the poultry flock has been increased from birds in 1921 of which only 35 per cent laid over 200 eggs to fowls in 1924 of which 56 per cent had laid over 200 eggs and 9 per cent over 250. The eggs of 68 hens and 44 pullets laid in 1923–24 were classified according to weight, shell color, texture, and shape, and the results given. A statistical analysis of the egg production at different seasons of the year showed significant correlations between the winter and the annual egg production. Early maturing birds had larger egg records, but no relation was observed between the number and the size of the eggs, although the size of the eggs was related to the size of the birds.

[*Feeding experiments*] (pp. 40–42).—In the studies of various rations for laying hens, 14 lots of pullets were selected.

Three lots were used for a test of the value of adding yeast, orange juice, and cod liver oil to the basal ration. A fourth pen was used as a control, and it was found that a very heavy mortality occurred in this pen receiving only grain and mash. Dry yeast also proved of little value for egg production, health, or fertility. The cod liver oil pen proved superior, with orange juice second, thus indicating that the vitamins of cod liver oil and orange juice are valuable with rations low in animal protein when no green feed is furnished.

Four pens were used for testing the value of certain constituents of sour milk. The results so far indicate that milk curd contains most of the valuable nutrients. Milk casein gave better results than milk whey or protein-free sour milk, but lactic acid and milk salts had no effect on production or the condition of the birds.

In other trials 50 per cent protein meat scraps produced larger amounts of eggs more economically than 60 per cent of meat meal. A 40 per cent pea meal mash supplemented with 4 per cent mineral mixture did not prove as successful as a mash containing 20 per cent pea meal and 20 per cent meat meal or meat scrap. Sour milk in unlimited quantities proved the most valuable supplement to pea meal. Semisolid buttermilk, while not as valuable as sour milk, gave better results than meat scrap or meat meal as a supplement to pea meal.

A study of the relative values of certain succulent feeds and alfalfa meal as sources of vitamin A for poultry, D. E. DAVIS and J. R. BEACH (*California Sta. Bul.* 384 (1925), pp. 3–14, fig. 1).—This bulletin reports the results of a 102-day study of the ability of various green feeds and alfalfa meal to prevent the occurrence of the nutritional disease resembling roup in poultry (E. S. R., 52, p. 77).

In conducting the test, 10 lots of 6 3-months-old pullets were selected and fed on a basal mash consisting of 25 per cent each of bran, shorts, and ground barley or corn meal, 10 per cent soy bean meal, and 15 per cent meat scrap, and a scratch feed of equal parts of wheat, re-cleaned barley, and white corn or later yellow corn. The average food consumption per bird was 22 gm. of mash and 44 gm. of scratch feed per day. The different lots received supplements of 1 gm. per day per bird of the following feeds: Field-grown green barley cut when from 6 to 10 in. high, red clover cut when from 2 to 4 in. high, the large leaves of Jersey kale, roots and tender stems of green alfalfa, blue grass lawn clippings, the entire plant of artificially sprouted barley grown indoors to a height of 3 or 4 in., common market varieties of carrots, mangels, and alfalfa meal of good color containing 17.2 per cent protein and 25.4 per cent fiber. The tenth group was reserved as the control and received no supplemental feed. As birds developed evidence of nutritional disease in a lot the amount of green feed was increased. The

maximum amounts of the different supplements which it seemed necessary to feed during the experiments were kale, green alfalfa, blue grass, and carrots 1 gm. each; green barley and red clover 2 gm. each; alfalfa meal 8 gm.; sprouted barley 16 gm.; and mangels 32 gm.

All 6 birds in the control lot and 5 of the 6 in the mangel lot died of nutritional disease during the test. The birds receiving the blue grass were all healthy, while 1 each receiving kale, green alfalfa, and carrots developed lesions between the eighty-fifth and ninetieth days, which persisted to the close of the experiment. Birds in the other lots developed characteristic lesions earlier in the test. The lot receiving red clover showed a tendency to eat their eggs, and at least 2 individuals were picked to death.

The authors point out that field-grown green crops and carrots were good sources of vitamin A. At least 20 per cent of the sprouted barley or 10 per cent of alfalfa meal in the ration was necessary to supply an adequate amount of vitamin A. Mangels were concluded to be practically valueless as a source of this material.

The fattening of immature cockerels, R. E. LOUCH (*Natl. Poultry Jour.*, 5 (1924), No. 230, p. 275).—The results are summarized of two experiments in fattening young cockerels conducted at the Cheshire School of Agriculture. The fattening period in both experiments was of 3 weeks' duration, using 21 birds in each case. The ration used in the first experiment consisted of equal parts of barley meal, corn meal, and thirds mixed with water and fed as a slop in troughs. The birds averaged about 1 lb. in weight at the beginning of the test..

The average gains per bird during the 3 weeks were 0.9 lb., approximately 4.25 lbs. of grain being consumed per pound of gain. A summary of the weekly gains made showed that the gains were greatest during the first 2 weeks, 9.5 and 7.5 lbs., respectively, for the 21 birds as compared with 2.75 lbs. during the third week.

In the second experiment the birds were slightly heavier, averaging about 1.5 lbs., and the ration fed in the first experiment was modified by replacing the barley with ground oats. The total gains made by this lot of 21 birds during the first, second, and third weeks were 6.75, 17.75, and —7.5 lbs. The fattening process in both experiments was done at a profit over feed cost.

Commercial poultry farming, T. W. TOOVEY (London: Crosby Lockwood & Son, 1924, 3. ed., pp. VIII+148, pls. [16], figs. 2).—This is a description of the operation of the King's Langley Poultry Farm, dealing with the hatching, rearing, housing, feeding, management, and diseases of chickens and laying hens, with a chapter on Indian Runner ducks.

British poultry and poultry keeping, S. H. LEWER (London: Feathered World, 1924, pp. 108, pls. 8, figs. 135).—Mainly a description of the breeds of fowls, ducks, geese, and turkeys, containing several colored plates.

The production of rabbits [trans. title], J. BAGUÉ (*Porto Rico Dept. Agr. and Labor Sta. Circ.* 76 (1924). Spanish ed., pp. 18, figs. 6).—General directions for breeding, feeding, management, and caring for rabbits.

DAIRY FARMING—DAIRYING

[Dairy cattle experiments at the Idaho Station] (*Idaho Sta. Bul.* 135 (1925), p. 27).—Based on the birth records in the station herd, the average gestation period has been found to be 280 days, with the gestation of males averaging 2.4 days longer than females. The first gestation period is slightly shorter, and the calves are somewhat smaller. The average birth weight of 13 Holstein bull calves was 103.8 lbs. and of 41 heifer calves 93.3 lbs. In

Jerseys, 18 bull calves averaged 64.3 lbs. and 16 heifer calves 54.2 lbs. at birth. Holstein calves apparently weigh more in proportion to their dams' weights than Jerseys. The weights of cows indicated that Holsteins and Jerseys increase at approximately the same rate per month during pregnancy. Young animals, however, increase more rapidly than mature ones.

A study of the transmitting qualities of Holstein-Friesian dams for milk and butter fat production, T. A. BAKER (*Delaware Sta. Bul.* 139 (1925), p. 13).—A statistical study of 500 365-day records in volume 33 of the Holstein-Friesian Advanced Register Year Book has evidenced a correlation of 0.28 ± 0.087 for the milk yields and 0.41 ± 0.024 for the butterfat yields of dams and daughters.

Dairying in Kansas, J. C. MOHLER ET AL. (*Kans. State Bd. Agr. [Quart.] Rpt.*, 42 (1923), No. 167, pp. VI+460, pl. 1, figs. 228).—A popular account of dairying in Kansas, with special reference to the recommended practices in the feeding, breeding, and management and the control of diseases of dairy cattle.

Swiss bovine breeds (*Schweizer Rinderrassen*. [Muri, near Bern]: *Komm. Schweiz. Viehzuchtverbände*, [1924], pp. 83, figs. 32).—A popular account of the cattle breeds of Switzerland (Schwyz, Simmental, Fribourg, and Eringer cattle) written in English and German.

The influence of pasteurization and diet of the cow on the antiscorbutic potency of milk, T. M. OLSON and L. COPELAND (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 370-380, figs. 5).—The antiscorbutic properties of the milk from cows on a winter ration with and without silage and before and after pasteurization were compared at the South Dakota Experiment Station.

Guinea pigs were used as the experimental animals, the basal ration consisting of rolled oats, autoclaved alfalfa hay, water, and salt, the milk to be tested being supplied in addition. Four guinea pigs receiving the basal ration only showed symptoms of scurvy early, and all died between the nineteenth and thirtieth days. Four other guinea pigs having a basal ration supplemented with 30 (two animals), 45, and 60 cc. daily of pasteurized milk died in from 54 to 97 days, the maximum life being of one of those receiving only 30 cc. daily. All of four other pigs, receiving like amounts of raw milk from the college herd which received corn silage in their ration, made good growth. Twenty cc. or less of this milk proved insufficient for normal growth, though only one of the four pigs on rations of from 15 to 20 cc. of this milk showed scurvy symptoms and died.

Eight other guinea pigs receiving supplements of raw milk from a herd not receiving silage did not show normal growth, and all receiving less than 30 cc. developed scurvy in 30 days. Three of the pigs receiving 30 cc. or more also died, the first death occurring at 108 days, while one pig was still alive and growing at the conclusion of the test after 25 weeks.

The authors conclude that pasteurization and the use of dry roughage only in the winter ration materially diminish the vitamin C content of the milk produced.

Relation between the diet, the composition of the blood, and the secretion of milk of dairy cows, C. A. CARY and E. B. MEIGS (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 12, pp. 603-624, figs. 12).—The effect of changes in the diet on the composition of the blood and milk has been studied in 8 experiments at the Bureau of Dairying, U. S. D. A.

The procedure in the experiment consisted generally in feeding the cows a ration supplying nearly adequate amounts of protein and energy for maintenance and production, followed by a period in which either or both the protein

and energy were reduced approximately 50 and 33 per cent, respectively. The quality of the protein was also changed with 3 of the cows. A deficiency feeding period was usually followed by one in which adequate rations were again supplied. Determinations were made during all periods of the reducing sugars, lipoid phosphorus, amino acid, nitrogen, protein, and free tryptophane content of the blood and plasma and the nitrogen, lactose, and fat content and yield of milk.

The effect of the changes in the diet on the composition of the blood and the milk are tabulated in detail and shown graphically. The relation between the composition of the blood and milk secretion is completely discussed. The results generally indicated that reductions in the energy content of the ration were accompanied by a sharp reduction in the amino acid nitrogen of the blood plasma. The even greater reductions in the protein of the ration did not greatly affect the amino nitrogen of the plasma. Changes in the quality of the protein have some effect, however, under different circumstances, efficient protein mixtures being associated with a low amino nitrogen content. Alterations in the amount or quality of the proteins tended to modify markedly the amount of free tryptophane in the blood.

Based on the changes occurring in the composition of the blood and the milk and the milk yield following dietary changes, the authors conclude that the effects on milk secretion are mainly due to alterations in the quantity and quality of the amino acids of the blood plasma.

A study of the relation between feed consumption and milk secretion, C. W. TURNER (*Jour. Dairy Sci.*, 7 (1924), No. 6, pp. 535-546, figs. 2).—Based on records of feed consumption, milk production, live weight, age, and the breeding of about 50 Holstein-Friesian cows on test at the Illinois Testing Plant at Dixon, Ill., the author has shown that feed consumption, based on digestible nutrients consumed, increases to the fourth month of lactation, after which it decreases but at a slower rate than milk secretion. This makes an excess of nutrients which go toward increasing body weight.

The data are presented by monthly periods in several tables.

Feed cost of milk production as affected by the percentage fat content of the milk, W. L. GAINES (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 12, pp. 593-601, figs. 2).—This is a theoretical discussion of the relation of the fat content of milk to the feed cost of milk production, with the presentation of formulas for calculating the nitrogen required for maintenance and the production of milk containing varying fat percentages, with the calculated constants for each formula for Jersey and Holstein cattle. A formula for adjusting the price of milk in proportion to the cost of production is also suggested. The work was conducted at the Illinois Experiment Station.

The official test in the South and the preliminary milking, E. BRINTNALL (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 393-402, figs. 3).—The relative changes in the butterfat test of the milk of cows occurring under normal conditions and after about one-third of the milk has been left in the udder from the preceding milking were determined in a series of experiments at the Mississippi Experiment Station. It was found that variations in the fat percentage were usually small, and might be in either direction after leaving the milk in the udder. The milk yield was, however, in such cases usually increased decidedly. No advantage in the 2-day test was found for leaving the milk in the udder, and in many cases the butterfat test was lowered. This practice could be determined by comparing the milk yield at the first milking with that of succeeding milkings.

Make the dairy pay, F. E. BALL (*Colorado Sta. Bul.* 295 (1924), pp. 60, figs. 36).—Directions for testing milk and cream by the Babcock method are given, with other data relating to milk and cream production and handling.

Milking machines.—VIII, **The sanitary efficiency of a simplified type of milking machine**, F. L. MICKLE (*New York State Sta. Bul.* 524 (1924), pp. 3-48, pls. 12, figs. 2).—In continuing this series of studies (E. S. R., 47, p. 480), the bacterial contamination of milk by the Surge milker (a new and simplified type of milking machine) has been investigated at four farms under ordinary conditions of milking.

The tests indicated that with ordinary care milk having reasonably low bacterial counts may be produced with this milker. The numbers of bacteria were found to compare favorably with the bacterial counts of milk drawn by other milking machines, including the Empire and B-L-K milkers which were in ordinary use on these farms.

Due to the varying influence of different factors on the bacterial content of the milk, machines cared for in the usual manner were used for drawing sterile water from an artificial udder, previously described (E. S. R., 41, p. 277), into sterile pails. The results with the Surge, Empire, Pine Tree, and B-L-K milkers were compared at five different farms in this way. The various methods of sterilizing the machines both in the actual milking itself and in the tests with the artificial udder included the use of brine, chloride of lime, Sterilac solution, and hot water. Satisfactory results were obtained with all the machines when properly cleaned, but the Surge milker apparently contaminated the milk slightly less than the other types.

Enzymatic studies on lactic acid bacteria, I, II [trans. title]. A. I. VIRTANEN (*Hoppe-Seyler's Ztschr. Physiol. Chem.*, 134 (1924), No. 4-6, pp. 300-319, figs. 2; 138 (1924), No. 3-6, pp. 136-143).—Based on the number of bacteria in dried samples of the sediment of centrifuged milk which had previously been inoculated with *Streptococcus lactis*, the author estimated the average weight of a dried bacterium at $\sqrt[10]{10}$ mg., while the live weight ranged from 5 to 10 times as great. The rate and amount of action of the bacteria and the production of zymophosphates was studied with living and nonliving cells at different grades of acidity and phosphate concentration. There was an enzymatic reduction of methylene blue in aqueous solutions by the living organisms but not after drying.

The breaking down of a solution of $Mg_2P_2O_7$ by *Bacillus casei* ϵ in a glucose solution, with the formation of a zymophosphate, was found to be very rapid, resulting in the freeing of over 30 per cent of the phosphate in certain cases within 9 hours. There was a greater amount of phosphate freed when the glucose and phosphate were mixed in the proportion of 1.25 radicals of PO_4 to 1 molecule of glucose than in the proportion of 2.6:1. Heating the bacteria to boiling or washing the bacteria eight times with water destroyed its ability to break down the phosphate compound. The operation of a coenzyme in the fermentation was thus indicated.

The mold associated with the ripening of blue veined cheese, N. S. GOLDING (*Mycologia*, 17 (1925), No. 1, pp. 19-32, pl. 1).—In a study of the organisms responsible for the characteristics of Wensleydale cheese, it was found that a mold resembling *Penicillium roqueforti* predominated. The reverse side of a growth on potato agar was yellow for *P. roqueforti* but green for the Wensleydale mold. The latter mold had no white patches of hyphae as occurred with the former organism. *P. roqueforti* never produced acid in whey gelatin but digested casein four times as fast as the Wensleydale mold. The latter variety also grew less freely on synthetic media containing saccha-

rose, galactose, levulose, or dextrose, but more freely when containing casein or peptone.

Factors affecting the yield of ice cream, H. W. GREGORY and V. C. MANHART (*Indiana Sta. Bul.* 287 (1924), pp. 3-31).—The authors have made a study of the yield of ice cream through questionnaires sent to five members of each of 28 State and other ice cream manufacturing associations. The results are tabulated to show, in the opinion of the 57 manufacturers reporting, the effect of the different processes and ingredients of ice cream on the overrun.

The factors affecting overrun were divided into three groups by the authors, composition of mix, preparation and treatment of mix, and freezing conditions. In regard to composition, binders and fillers, except gelatin, were reported to have no effect on overrun. Milk solids-not-fat tend to increase the overrun, while milk fat, sugar, and gelatin are deterrents. In the preparation of the mix, it is the opinion that aging increases overrun while pasteurizing reduces it. The freezing conditions favorable to overrun were deemed to be a temperature of from 32 to 36° F. for the incoming mix, with not over 5° of difference in the temperature of the incoming and outgoing brine and a horizontal freezer half full rather than the more common vertical type. Other conditions were reported as influencing the overrun, but with a greater variability of opinion.

Overrun of ice cream (*Idaho Sta. Bul.* 135 (1925), p. 28).—It was found possible to make a good quality ice cream from slightly acid products after neutralizing, but the use of calcium hydroxide resulted in a loss of 16.9 per cent and sodium hydroxide of 8.85 in the overrun.

Sandiness in ice cream, P. S. LUCAS and G. SPITZER (*Indiana Sta. Bul.* 286 (1925), pp. 12).—This is a more complete report of the investigation of the cause and influence of various factors on sandiness in ice cream (*E. S. R.*, 49, p. 580).

In making this study 124 mixes were prepared so that the fat content of each was approximately 8 per cent and the sum of the sugar, gelatin, and flavor contents was 11 per cent. The total solids contents were calculated to be 27, 30, 33, and 36 per cent by varying the solids-not-fat content. The mixes were pasteurized, emulsified, aged, and frozen, after which the product was periodically examined for sandiness while being held at 0° temperature. Milk powder was used in the preparation of part of the mixes, while others were prepared with condensed milk. Total solids, fat, and lactose determinations were made of the ice cream and of the mixes.

It was found that most of those samples containing approximately 7 per cent or more of milk sugar developed sandiness, while none containing less than 7 per cent of milk sugar was sandy. Sandiness is apparently not affected by carbonization, pasteurization temperatures varying from 145 to 164° F., ice cream powders or improvers, or by the amount of overrun.

The work was supplemented by chemical studies of the rate of crystallization of lactose in mixtures of various sorts at a temperature of from 32 to 34°. The prevention of sandiness may be accomplished by the avoidance of excessive milk solids not fat, thorough solution of all ingredients, thorough pasteurization, constant temperature in the hardening room, and holding the frozen creams for a minimum time.

The bacterial content of ice cream, A. C. FAY and N. E. OLSON (*Jour. Dairy Sci.*, 7 (1924), No. 4, pp. 330-356).—The bacterial content of the mix was determined on 28 samples at different stages in the production of ice cream at the Kansas Experiment Station. The average bacterial counts determined were as follows: Before pasteurizing (calculated from bacterial content of

butter and mix determined separately) 17,261,926, after pasteurizing 219,953, after homogenizing 277,475, before aging 191,782, before freezing 192,362, after freezing 236,688, and after hardening for 48 hours 186,320 bacteria per gram. By using more care in the production, the bacterial count of the hardened product was reduced from 617,357 in the first 8 mixes to 35,432 bacteria per gram in the last 20.

By making bacterial counts, it is possible to detect the use of dirty utensils, improper pasteurization, or the use of low-grade materials, though proper pasteurization may tend to conceal the latter. In studying the types of organisms in the ice cream, pasteurization was found to kill practically 100 per cent of the acid and gas-forming bacteria and an average of 99.0 per cent of those producing acid without gas formation in lactose. It also caused a decrease of 86 per cent in the gelatin liquefiers.

VETERINARY MEDICINE

Pocket handbook of meat inspection, G. LEIGHTON (*Edinburgh: William Hodge & Co., Ltd.*, 1924, pp. VIII+126).—This is a small handbook which gives a concise explanation of the meat inspection regulations of Scotland for 1924.

Animal parasites and parasitic diseases, B. F. KAUPP (*Chicago: Alexander Eger*, 1925, 4. ed., rev., pp. XVI+9-250, pls. 18, figs. 81).—This is a revised edition of the work previously noted (*E. S. R.*, 32, p. 79).

Biennial report of the Live Stock Sanitary Commission of Texas for the years 1923-24 (*Tex. Livestock Sanit. Comm. Bien. Rpt. 1923-24* pp. 23, figs. 2).—Included in this report is an account of the tick eradication work, the outbreak of and control work with foot-and-mouth disease, scabies eradication work, tuberculosis eradication, and control work with anthrax.

Yearly reports in regard to the progress made in veterinary medicine [trans. title], edited by W. ELLENBERGER, K. NEUMANN, and O. ZIETZSCHMANN (*Jahresber. Vet. Med.*, 41-42 (1921-1922), pp. V+496).—This yearbook, covering the years 1921 and 1922, is in continuation of those previously noted (*E. S. R.*, 50, p. 76.)

Annual administration report of the Civil Veterinary Department, Madras Presidency, for 1923-1924, D. A. D. AITCHISON (*Madras Civ. Vet. Dept. Ann. Admin. Rpt. 1923-24*, pp. 20).—This is the usual annual report (*E. S. R.*, 50, p. 783).

Report on the Veterinary Department [Gold Coast] for the period April, 1923-March, 1924, W. P. B. BEAL (*Gold Coast Vet. Dept. Rpt. 1924*, pp. 16).—This report includes an account of the occurrence of infectious diseases of livestock in the Gold Coast.

Veterinary prescriptions, G. GEROSA (*Ricettario del Veterinario. Milan: Istituto Sieroterapico*, [1923], pp. VIII+279).—This is a pocket handbook on materia medica, containing numerous prescriptions.

On the toxic action of carbon disulphide [trans. title], K. MUTO (*Jour. Japan. Soc. Vet. Sci.*, 2 (1923), No. 3-4, pp. 263-280, pl. 1).—This is a first report, by the director of the Army Veterinary College at Tokyo, based upon experiments with mice, guinea pigs, and rabbits. He finds that 1.5 volume per cent of carbon disulfide in the air is the minimum lethal dose, causing an acute intoxication, while 3 volume per cent is sufficient to kill the animal within 10 minutes. Death is shown to be due to paralysis of the respiratory center. The respiration of the intoxicated animal is at first accelerated, then becomes slow, and finally stops. The blood pressure rises with the acceleration of respiration and suddenly falls at the stage of apnoea.

[Immunity] (*Brit. Med. Jour.*, No. 3337 (1924), pp. 1095-1111, figs. 5).—This symposium, held by the section of pathology and bacteriology of the British Medical Association at the 1924 meeting at Bradford, England, includes papers on the general subject of immunity with special reference to specificity and nonspecificity by R. A. O'Brien and W. J. Tulloch, and on special phases of the subject as follows: Chemical Structure and Specificity, by P. Hartley; The Specificity of Acquired Immunity and Non-specific Factors in Immunization, by T. J. Mackie; The Effects of Physical and Chemical Agencies on Bacterial Vaccines, by L. S. P. Davidson; The Mechanism of the Non-specific Reaction, by D. Campbell; The Effect of Detoxication on the Specific Antigenic Properties of *B. typhosus*, by E. M. Dunlop; and Some Products of Autolysed Tubercle Bacillary Cultures, with Special Reference to Their Antigenic and Curative Value in Tuberculous Infections, by R. Row.

Anaphylaxis (*Anafilassi. Milan: Istituto Sieroterapico, 1923, pp. 363*).—This volume consists of papers by different specialists on various phases of anaphylaxis as follows: A General and Historical Discussion of Anaphylaxis, by A. Lustig; Anatomical-Pathological Changes in Anaphylaxis, by A. C. Demel; Serum Anaphylaxis, by C. Comba; Food Anaphylaxis, by P. Rondoni; Anaphylactic Bronchial Asthma, by C. Frugoni; Anaphylaxis in Surgery, by G. Fichera; Tachyphylaxis, by D. C. Bianchi; Tubercular Hypersensitiveness and Its Relation to Anaphylaxis Immunity and the Specific Therapy of Tuberculosis, by F. Micheli; Idiosyncrasy and Paradoxical Phenomena, by A. Zironi; and Synthesis, by S. Belfanti.

[Report of the] division of veterinary science, J. W. KALKUS (*Washington Col. Sta. Bul. 187* (1924), pp. 80, 81).—A brief statement of the status of work with bovine abortion, which is said to be responsible for from 85 to 90 per cent of the abortions and other reproductive troubles in western Washington.

The significance of *Bacterium abortus* antibodies (agglutinins and complement-fixing) found in the sera of calves at birth or after nursing, I. F. HUDDLESON and D. E. HASLEY (*Michigan Sta. Tech. Bul. 66* (1924), pp. 3-16).—In this continuation of the work of the station on bovine infectious abortion (*E. S. R.*, 52, p. 481), the particular phase studied was the rôle played by the calf in the transmission of the disease.

The general plan followed was to examine by the complement fixation and agglutination tests the blood sera of calves from cows with a previous history of natural or artificial infection, starting if possible before the first nursing and continuing until after conception or parturition. Examinations for *B. abortus* were also made of the uterine exudate and milk of the dams and the organs and fetuses of the heifers slaughtered before parturition. In general, the technique followed was the same as described in an earlier paper (*E. S. R.*, 47, p. 584). In all 10 heifer calves and 1 bull calf were thus studied, the individual animals being under observation for periods varying from one to more than two years from the date of birth.

The blood serum of 1 calf and probably of 6 others was not tested before the ingestion of colostrum. All but 1 of these gave positive reactions to one or both tests at the first bleeding. In 1 the test was negative at first and positive one week later. Of the others tested before nursing, the blood sera of 3 were negative to both tests and became positive to one or both tests after nursing. In the one remaining case the blood was positive to both tests before nursing. This is thought to be a case of prenatal infection. The duration of the antibodies in the blood serum of the calves varied from 48 to 125 days.

All but 2 of the dams had been infected previously, and the presence of *B. abortus* was demonstrated in either the milk or uterine exudate at the time

the calves were born. The other 2, which had received injections of killed and living vaccines of *B. abortus*, never showed the presence of the organism.

The milk of 8 of the dams gave positive agglutination tests in dilutions of 1:200 or higher following parturition. Of the other three, 2 were not tested and 1 was negative. The blood serum in all cases gave positive results in one or both tests at the time of parturition.

Of the 10 heifer calves, 1 was accidentally killed before reaching breeding age, 6 were bred and slaughtered at different periods of gestation for examination of the fetus and uterus, and 3 were bred and gave birth to normal calves. The presence of *B. abortus* was not demonstrated in the uterus or fetus of any of the heifers slaughtered before parturition. Negative results were also obtained with the blood of calves and the blood serum and milk of the dams which calved normally.

These results are thought to demonstrate "the improbability of *B. abortus* persisting in the tissue of newborn calves from a prenatal infection or through the ingestion of milk containing *B. abortus* if demonstrable antibodies are interpreted as signifying an infection. There is no evidence to show that calves from infected cows are more susceptible to calves' diseases, or that the breeding efficiency is impaired in any way."

One point brought out incidentally in this investigation is the possibility of controlling the disease by separating infected from noninfected animals and keeping them in separate inclosures on the same premises. This was done in the present investigation, and although the experimental animals were cared for by the same person who also cared for the uninfected herd there was no transmission of infection. It is thought that the spread of the disease through such indirect means has been overestimated.

Variations in the concentration of the globulin and albumin fractions of the blood plasma of young calves and a cow following the injection of *Bacillus abortus*. Variations in the concentration of the protein fractions of the blood plasma of pregnant and non-pregnant cows or of cows which have aborted, P. E. HOWE and E. S. SANDERSON (*Jour. Biol. Chem.*, 62 (1925), No. 3, pp. 767-788, figs. 5).—This investigation of the effect of immunization with living bacteria (*B. abortus*) upon the distribution of the proteins of the blood sera included studies conducted on 4 calves and 1 cow. The general plan of the experiment was to produce a high titer serum by subcutaneous injections of living bacteria (*B. abortus*) and to compare the increase in antibodies with the composition of the proteins of the blood plasma. The calves all received colostrum from their mothers before being fed milk obtained from cows in advanced stages of lactation. Two of the calves at the age of 50 days were given a subcutaneous injection of 1 cc. of a suspension of *B. abortus* equal in density to a 24-hour bouillon culture of *B. typhosus*. Following a second injection 3 weeks later, 1 of the calves died and there was substituted another calf 41 days old. The injections were continued at 20-day intervals until the first calf was 200 days old. The final amounts given were 3.5 cc. for the first and 2.5 cc. for the substituted calf. Blood samples were taken in all cases just before and 2 days after each injection for determinations of complement fixing bodies, agglutinins, and the concentration of various globulin fractions. Similar experiments were conducted on the blood of a control calf and another calf was injected at varying intervals with washed rabbit corpuscles, and determinations were made of the hemolytic titer and the composition of the protein fractions of the blood.

Of the 5 cases studied, 2, including the 1 injected with washed rabbit corpuscles, did not produce detectable antibodies in any appreciable amount.

The other 2, whose blood was low in antibodies after the first suckling, developed a low titer with the first injection but showed no increase on subsequent injections. The control had a titer of from 1 to 20 following the colostrum feeding, and this was maintained with slight fluctuations until the end of the experiment.

There were no appreciable changes in the quantity or distribution of the proteins of the blood which could be attributed to the injection of *B. abortus* or of blood cells. In addition to the effect of age and the ingestion of colostrum, the slight fluctuations noted are attributed to the effect of the withdrawal of blood, the temporary effect of inoculation, and the response to changes in environment.

Analyses of the blood of a cow during the course of immunization against *B. abortus* with living bacteria showed a marked increase in globulin, with a slight decrease in albumin. The degree of immunity was not, however, directly related to the increase of globulin above the value obtained before immunization.

Data are also included on the composition of the blood of certain of the cows used at varying intervals following the original bleeding, when heifers, in the previously reported investigation by Smith and Little (E. S. R., 51, p. 478). Data are grouped according to the treatment received and according to whether the cows calved normally or aborted. In the case of normal calving, the data indicated that pregnancy and immunization do not cause any marked uniform change in the distribution of the protein fractions. In the cows which aborted there was in general an increase in the globulin and a slight decrease in the albumin content of the serum.

The differentiation of primary isolations of *Bacterium melitensis* from primary isolations of *Bacterium abortus* (bovine) by their cultural and atmospheric requirements, J. M. BUCK (*Jour. Agr. Research [U. S.]*, 29 (1924), No. 12, pp. 585-591).—Evidence is presented in this contribution from the Bureau of Animal Industry, U. S. D. A., that *B. melitensis* can be distinguished from *B. abortus* in primary cultures by guinea pig inoculation and subsequent cultivation of the tissues of the infected animal on serum agar at 37° C. under normal atmospheric conditions. Under the same conditions *B. abortus* does not develop. The failure to note any cultural differences between the two organisms in most of the studies hitherto reported is attributed to decreased sensitivity of the organisms to atmospheric conditions after prolonged artificial culture.

A list of 24 references to the literature is appended.

Experimental studies on anthrax infection and anthrax immunity [trans. title], T. TAMIYA (*Tokyo Imp. Univ., Govt. Inst. Infect. Diseases Sci. Rpts.*, 2 (1923), pp. 91-134, pls. 4).—Experimental studies were conducted upon guinea pigs to determine the manner of natural anthrax infection and the difference in reaction between immunized and nonimmunized animals toward injected bacilli. The results of these studies are summarized as follows:

Anthrax infection can be induced only with difficulty in the healthy membranes of the intestinal tract, but by ligating a portion of the tract, particularly in the region of the duodenum and appendix, the infection is more readily induced. In similar experiments conducted on animals treated with anthrax immune serum no infection was induced. Even in the ligated appendix only a local action resulted. The bacilli injected into the intestinal mucosa of both immunized and nonimmunized animals were frequently found in the intestinal contents, and those injected into immune animals had suffered no more change than those injected into nonimmunized animals.

If infection does not take place after passive immunization, the bacilli injected into the intestinal mucosa do not find their way to the tissues, although

there is no lowering of their virulence. This would seem to indicate that the immunization manifests itself by a heightened resistance of the tissues to invasion. This action is specific for anthrax serum and is not evident with immune serum of another kind or with normal horse serum. The latter occasionally shows a slight protective action, but it is qualitatively different from that of the specific serum.

The valuation of malleins [trans. title], H. KRÜGER (*Arch. Wiss. u. Prakt. Tierheilk.*, 50 (1924), No. 6, pp. 574-580).—A comparison is reported of three methods of standardizing malleins—the intracutaneous method of Schnürer, the complement-fixation method of Schreiber-Stickdorn, and a method similar to the Koch method of testing tuberculin by injections into tuberculous guinea pigs. The last method alone is considered to be of value.

[Proceedings of the Eastern States Conferences on Eradication of Tuberculosis in Livestock] (*East. States Conf. Erad. Tuberc. Livestock Proc.*, 1919, pp. 76; 1921, pp. 152; 1922, pp. 175; 5 (1924), pp. 136, figs. 12).—These are reports of the proceedings of the annual conferences held (1) at Chicago in October, 1919, and (2) in November, 1921, (3) at Hartford, Conn., in June, 1922, and (5) at Albany, N. Y., in June, 1924. The report of the proceedings of the fourth conference held at Concord, N. H., in June, 1923, remains unpublished.

The diagnosis of bovine mastitis by milk examination, A. L. SHEATHER (*Jour. Compar. Path. and Ther.*, 37 (1924), No. 4, pp. 227-242).—The investigations here reported show that a *Streptococcus* is the most frequent cause of contagious mastitis, and that it may also be caused by a diphtheroid bacillus. The information afforded by the use of bromocresol purple as an indicator of the reaction of a sample of milk does not permit a diagnosis of mastitis to be made in the majority of cases. The bacteriological examination of milk collected with every possible precaution against accidental contamination is the surest means of detecting animals infected with contagious mastitis.

A study of the blood of normal horses [trans. title], M. NAGAO (*Jour. Japan. Soc. Vet. Sci.*, 2 (1923), No. 3-4, pp. 251-262).—This records studies of the blood of geldings of from 5 to 19 years, respectively, each age being represented by from 2 to 15 animals. The number of red and white cells, with the percentages of the several varieties of leucocytes, are given for each animal examined, the details being presented in tabular form.

Corynebacterial pyaemia of foals, L. B. BULL (*Jour. Compar. Path. and Ther.*, 37 (1924), No. 4, pp. 294-298).—This is a report of investigations conducted at the Government laboratory of pathology and bacteriology at Adelaide Hospital, South Australia, in which a pyemia in foals with involvement of the lungs, alimentary canal, and mesenteric lymph glands is described. A diphtheroid bacillus with specific characteristics has been obtained in pure culture from the lesions, and it appears that this bacillus is the cause of the disease. It is pointed out that a similar disease in foals in Sweden has been described by Magnusson (*E. S. R.*, 50, p. 685), who isolated a bacillus with the same cultural characteristics as the one isolated from foals in South Australia.

Equine piroplasmiasis in France [trans. title], L. PANISSET and J. VERGE (*Rev. Gén. Méd. Vét.*, 33 (1924), No. 394, pp. 557-563).—The authors' investigations have shown that two forms of piroplasmiasis occur in France, which, though similar in their symptoms, are caused by two distinct parasites, one by *Piroplasma caballi*, the other by *Nuttallia equi*.

Carbon tetrachloride as an anthelmintic for horses [trans. title], L. DE BLIECK and E. A. R. F. BAUDET (*Tijdschr. Diergeneesk.*, 51 (1924), No. 7,

pp. 257-262; *abs. in Trop. Vet. Bul.*, 12 (1924), No. 4, p. 122).—The authors find carbon tetrachloride to be an excellent vermifuge for use against gastrophilus larvae, ascarids, oxyuris, and strongylids. A dose of 0.1 cc. per kilogram of body weight is recommended as safe and efficient.

The possible use of arecoline hydrobromide as an anthelmintic, I. C. ROSS (*Jour. Compar. Path. and Ther.*, 37 (1924), No. 4, pp. 246, 248-259).—The investigations here reported, which were conducted at the University of Sydney, Australia, have shown arecoline hydrobromide to be quite effective against tapeworms in the dog. It is quite ineffective against *Ascaris*, and probably against other nematodes. It may be safely and conveniently administered in aqueous solution containing 0.0625 grain per dram (0.001 gm. per cubic centimeter) at the rate of 0.0625 grain for dogs weighing from 5 to 10 lbs., 0.125 grain for dogs of from 10 to 20 lbs., 0.25 grain for dogs of from 20 to 30 lbs., and 0.5 grain for dogs over 30 lbs. It can be best administered when the stomach and small intestine are empty.

Dr. Little's dog book, G. W. LITTLE (*New York: Robert M. McBride & Co.*, 1924, pp. XX+345, pls. 32, figs. 19).—This is a semipopular account, largely of the accidents, parasites, and diseases to which the dog is subject.

Studies on bacillary white diarrhoea in poultry in Delaware, H. R. BAKER (*Delaware Sta. Bul.* 139 (1925), p. 14).—This is a brief tabulated summary of the breeding birds tested for white diarrhea during the years ended June 30, 1923 and 1924, respectively. Of the 1,868 fowls tested during the fiscal year 1924, 156, or 8.3 per cent, were found to be affected.

Diphtheria of fowls: Its cause, prevention, and cure, W. M. CROFTON (*Jour. Path. and Bact.*, 27 (1924), No. 4, pp. 456-458).—The author concludes that fowl diphtheria is caused by an influenzoid microbacillus. Its pathogenicity was established by its antigenic powers and confirmed by reproducing the disease in other hens.

RURAL ENGINEERING

Surface water supply of Snake River basin, 1919-1920 (*U. S. Geol. Survey, Water-Supply Paper* 513 (1924), pp. VI+318, pls. 2).—This report, prepared in cooperation with the States of Idaho, Oregon, Nevada, and Washington, presents the results of measurements of flow made on streams in the Snake River basin during the years ended September 30, 1919 and 1920.

Administration report with statistical statements and accounts for 1922-23, Irrigation Department, Punjab, W. P. SANGSTER ET AL. (*Punjab Irrig. Dept. Admin. Rpt.*, 1922-23, pp. [198], pls. 30).—The activities of the Irrigation Department, Punjab, for the fiscal year 1922-23 are presented.

The "artesian well" as a potential source of danger, C. N. and F. D. LEACH (*Amer. Jour. Pub. Health*, 14 (1924), No. 10, pp. 827-831, figs. 5).—In a contribution from the International Health Board of Manila, P. I., studies are reported of 46 artesian wells in the neighborhood of Manila.

The results showed that only 26 per cent of these wells are furnishing a potable water of good quality. Three of the negative wells, however, showed a high bacterial count. There is considered to be a strong possibility that the water from this small percentage of clean wells is contaminated by handling before reaching the consumer.

Of the wells examined, 45.6 per cent gave a positive dye test for leaky casings. Water for priming was obtained from nearby ditches. Eight of the 10 priming wells gave a positive presumptive test. Positive bacteriological tests were obtained from 71.7 per cent of the wells examined.

Effect of temperature upon the friction of water in pipes, F. E. GIESECKE (*Jour. Amer. Soc. Heating and Ventilating Engin.*, 30 (1924), No. 12, pp. 747-752, figs. 3).—In a contribution from the University of Texas a summary is given of data from hydraulic experiments, indicating the effect of temperature upon the friction of water in pipes. Tabular data to illustrate the results are included.

Run-off for open ditch land drainage, C. E. RAMSER (*Agr. Engin.*, 5 (1924), No. 10, pp. 222-226, fig. 1).—In a contribution from the U. S. D. A. Bureau of Public Roads data are summarized on the run-off from typical areas in Mississippi, western Tennessee, and western Iowa, the purpose being to demonstrate the importance of adequate run-off data as the basis for the design of open ditch drainage systems.

Physical properties of materials.—I, Strengths and related properties of metals and wood (*U. S. Dept. Com., Bur. Standards Circ. 181, 2. ed. (1924), pp. 204, pl. 1, figs. 60*).—This is the second edition of this publication (E. S. R., 46, p. 688).—It contains the values for tensile, compressive, and shearing strengths; ductility; modulus of elasticity; and other related properties of pure metals and their alloys and of wood. In addition to these, the properties of metals at elevated temperatures, and fatigue and impact properties, and the effect of heat treatment and cold working are also given. Other properties and uses of less commonly used metals are described briefly. Graphical representation is used in many cases to show the change of the properties of a material with changing conditions.

The properties and uses of wood, A. KOEHLER (*New York and London: McGraw-Hill Book Co., Inc., 1924, pp. XIV+354, figs. 129*).—In this contribution from the University of Wisconsin and the U. S. D. A. Forest Products Laboratory, an attempt is made to present in a nontechnical manner the more important facts concerning the properties of wood and how these properties affect its utilization. Chapters are included on the structure of wood, its physical properties, the mechanical properties or strength of wood, factors affecting the strength of wooden members, chemical properties of wood and their practical application, air seasoning of wood, kiln-drying, deterioration of wood, protection of wood against decay and fire, principal factors governing the use of wood, kinds and quantity of wood used for various purposes, measurement of timber products, and commercial grading and standard sizes of lumber.

Utilizing poles and timber in farm building, G. AMUNDSON (*Mich. Agr. Col. Ext. Bul. 24 (1924), pp. 36, figs. 47*).—Practical information on the utilization of poles and timber in the construction of houses and farm buildings, with particular reference to Michigan conditions, is presented. Numerous diagrammatic illustrations and working drawings of structures built of such materials are included.

Foundations, abutments, and footings, G. A. HOOL and W. S. KINNE (*New York and London: McGraw-Hill Book Co., Inc., 1923, pp. XIV+414, figs. [183]*).—This is a reference work covering the design and construction of foundations, abutments, and footings, and including a complete treatment of the elementary theory involved. Sections are included on soil investigation, excavation foundations, spread footings, underpinning, foundations requiring special consideration, bridge piers and abutments, and legal provisions regarding foundations and footings.

Relative effects of some nitrogen compounds upon detonation in engines, T. A. BOYD (*Indus. and Engin. Chem.*, 16 (1924), No. 9, pp. 893-895, figs. 3).—Studies are reported which showed that nitrogen in some of its compounds

exerts a greater influence upon the character of combustion in internal-combustion engines than any other element of small atomic number. The action of nitrogen is influenced in a large way by the elements of radicals attached to it. Thus in some of its compounds it is quite effective for suppressing detonation, in some it is almost neutral, and in some it exerts the remarkable effect of inducing detonation. For example, detonation is suppressed by aniline, it is affected very little by pyridine, and it is induced or increased by propyl nitrate.

In general the nitrogen compounds which are most effective for suppressing detonation are the primary and the secondary amines. Of these the aryl amines, or those that contain at least one aryl group, have much the larger influence for eliminating detonation from internal-combustion engines.

A suggested mechanism for antiknock action, G. L. WENDT and F. V. GRIMM (*Indus. and Engin. Chem.*, 16 (1924), No. 9, pp. 890-893, fig. 1).—Studies are reported the results of which suggest tentatively that during an explosion in an automotive engine the explosive flame is propagated by the emission of electrons from the reacting molecules, in that the advance of these electrons before the flame front ionizes and activates the unburned molecules, causing detonation at high temperatures and pressures. On this hypothesis the function of such materials as tetraethyl lead is to absorb electrons and to promote the recombination of ions previous to combustion, thus reducing the normal acceleration of the combustion rate.

It was found that tetraethyl lead and other antiknock compounds do actually have a marked effect in recombining gaseous ions at ordinary pressures and temperatures, while the knock inducers similarly tested have no effect. Attempts to reduce the rate of combustion by the application of magnetic and electrostatic fields were unsuccessful.

Power for the farm from small streams, A. M. DANIELS, C. E. SEITZ, and J. C. GLENN (*U. S. Dept. Agr., Farmers' Bul. 1430* (1925), pp. 11+36, figs. 40).—This publication, prepared under a cooperative agreement between the Bureau of Public Roads and the Virginia Polytechnic Institute, presents data from a survey, the purpose of which is mainly to acquaint farmers with the possibilities of developing the power of small streams by converting it into electrical energy, and with the uses to which such power can be put.

Let the creek light your home, A. B. CRANE (*Wash. State Col. Ext. Bul. 124* (1924), pp. 15, figs. 11).—Practical information on the development of small hydroelectrical power plants on farms in Washington is presented.

Fitting the farm saws, L. M. ROEHL (*N. Y. Agr. Col. (Cornell) Ext. Bul. 94* (1924), pp. 36, figs. 42).—Practical information on the sharpening and fitting of farm saws is presented.

Equipping an orchard spray machine for use in alfalfa fields, C. WAKELAND (*Idaho Agr. Col. Ext. Circ. 25, reprint* (1924), pp. 4, figs. 4).—This is a reprint (*E. S. R.*, 47, p. 592).

Emissive tests of paints for decreasing or increasing heat radiation from surfaces, W. W. COBLENTZ and C. W. HUGHES (*U. S. Dept. Com., Bur. Standards Technol. Paper 254* (1924), pp. 171-187, fig. 1).—Experiments on the emissivity of heat from sheet iron, cotton duck, roofing material, artificial leather, and other fabrics covered with white paint, vitreous enamel, and aluminum paint are reported.

It was found that aluminum paint emits only from 30 to 50 per cent as much thermal radiation as the unpainted material and as the white paint, vitreous glass enamel, or other nonmetallic coatings. The application of these data to house radiators is discussed. It is pointed out that owing to the fact that house radiators are essentially convectors of heat, a gain of only from

10 to 15 per cent in heat dissipation into the room may be expected by covering the surface of the radiator with a paint which is free from flakes of metals.

Fighting rust with sublimed blue lead (*Chicago: Eagle-Picher Lead Co., 1923, pp. 80, figs. 23*).—Data are presented on the properties and uses of sublimed blue lead, with particular reference to preventing corrosion of iron and steel. Chapters are included on corrosion of iron and steel; rating of rust-proofing paints by the American Society for Testing Materials; sublimed blue lead; use of sublimed blue lead; suggested painting specifications for structural steel work; and estimates, data, and tables.

Poultry house construction, H. A. D. LEGGETT (*Vt. Agr. Col. Ext. Circ. 31 (1924), pp. 20, figs. 19*).—Practical information and working drawings for poultry houses adapted to conditions in Vermont are presented.

Artificial illumination of poultry houses for winter egg production, F. L. FAIRBANKS (*N. Y. Agr. Col. (Cornell) Ext. Bul. 90 (1924), pp. 28, figs. 19*).—Data from two years' studies on the artificial illumination of poultry houses for winter egg production are reported and discussed.

The results indicate that the general illumination of the pen is quite as important as the illumination of the floor. It was found that even with the proper intensity of light on the feeding floor a number of the birds did not come down to feed if the perches were dark, but that when the lighting unit was changed so as to throw light on the perches, and at the same time keep the proper floor intensity, all the birds came down to feed.

The details of the electrical apparatus used are presented. It was found that to find the number of lighting units that will be required for a pen of a given size, the number of square feet of floor space should be divided by 200; the nearest whole number will be the number of units required. The lighting units should be placed 6 ft. from the floor and 10 ft. apart along a line midway between the front of the house and the front of the dropping board.

Poultry equipment made at home, B. WINTON and W. C. BONEY (*Missouri Agr. Col. Ext. Circ. 151 (1924), pp. 16, figs. 24*).—Practical information and working drawings relating to equipment for the feeding, watering, and housing of poultry, with particular reference to conditions in Missouri, are presented.

Some fundamentals of the ventilation of animal shelters, R. W. TRULLINGER (*Agr. Engin., 5 (1924), No. 11, pp. 253-256, 258, fig. 1*).—In a contribution from the U. S. D. A. Office of Experiment Stations, a brief summary is given of some of the more important points of the available fundamental knowledge of ventilation as influenced by the specific requirements of livestock and poultry, and an analysis is given of what are considered to be the necessary preliminary considerations in a study of the ventilation of animal shelters.

Attention is drawn to the rather prevalent disagreement among investigators regarding the requirements of animals with reference to temperature and ventilation. It is concluded that the results of ventilation studies can be of no more than speculative accuracy unless they have been conducted under controlled conditions with animals, the health, comfort, economy, and productiveness values of which are known with a reasonable degree of accuracy as judged by suitable standards. This is considered to indicate the necessity of close cooperation between the agricultural engineer and animal husbandman in such work, and the employment of methods and apparatus similar to those used in respiration calorimetric studies to provide the proper basis for the design of ventilation systems.

Cold storage on the farm, R. R. GRAHAM (*Ontario Dept. Agr. Bul. 306 (1924), pp. 32, figs. 21*).—In this revision of Bulletin 207 (E. S. R., 29, p. 88),

practical information on the planning and construction of ice houses and cold storages for farm use, with particular reference to conditions in Ontario, Canada, is presented.

Ice-making and cold-storage plants in Australia and New Zealand (*U. S. Dept. Com., Bur. Foreign and Dom. Com., Trade Inform. Bul. 280 (1924), pp. II+33*).—Data on the particulars of ice making and refrigerator installations in Australia and New Zealand are presented.

Home conveniences, F. W. IVES (*New York and London: Harper & Bros., 1924, pp. XI+219, figs. 74*).—This is one of Harper's Handbooks, edited by W. C. O'Kane. Its purpose is to set forth briefly some of the things that make for comfort about the home and to aid the householder in the selection of appliances. While of an extremely popular nature, it is a striking example of the results of extensive fundamental work in agricultural engineering in which it is known that the late author was long engaged. It contains chapters on heating appliances, ventilation, cooking appliances, home laundry equipment, plumbing fixtures and accessories, disposal of waste, refrigeration for the household, cupboards and closets, cleaning devices, handy household devices, labor-saving kitchen devices, handy repairing conveniences, the electric motor and its application, the small internal-combustion motor and its application, lighting and light plants, the septic tank, methods of getting water into the house, and suggestions for reading.

Studies on the biology of sewage disposal, W. RUDOLFS ET AL. (*New Jersey Stas. Bul. 403 (1924), pp. 95, figs. 39*).—This is the third annual report of this joint project of the stations and the New Jersey State Department of Health (*E. S. R., 51, p. 685*). Separate studies have also been reported from time to time and noted in the *Record*.

Studies by F. L. Campbell and Rudolfs on operating and resting Imhoff tanks showed that practically all observations and determinations made on the resting and operating tanks pointed to a rise and then a fall in sludge digestive activity during the course of the tests. High amounts of ammonia were found to correspond with a low percentage of carbon dioxide production except in the cases during and shortly after sludge drawing, when the ammonia produced had not yet had a chance to accumulate. The carbonates reached the highest peaks shortly after those for carbon dioxide and ammonia. The total acidity did not coincide with the greatest carbon dioxide production. A comparison of pH values with carbon dioxide content showed, in general, an inverse relation. Apparently H-ion concentration gives a true index of the total activities taking place in the tank. Foaming phenomena occurred when the pH values of the liquid between the scum and sludge were below 7, and foaming subsided when the H-ion concentration was above the neutral point.

Bacteriological investigations by M. Hotchkiss on operating and resting Imhoff tanks apparently established the fact that in these tanks there is an inverse relationship between the numbers of albumin-digesting and hydrogen-sulfide producing bacteria. This is taken to indicate that different types of digestion dominate at different times.

Studies of the fauna of Imhoff tanks and sprinkling beds by J. B. Lackey indicated the probability that the protozoa of Imhoff tanks afford a fair criterion as to the proper working conditions therein. When the tanks foam or seem to digest poorly the number of protozoa is high, and when there is but little solid matter in the liquid the number tends to be small. It is considered questionable if their numbers are ever large enough to affect the bacteria in the tanks, the reverse being more likely. It was found that the number of

genera of protozoa in filter beds which occur with some regularity in numbers over 5,000 per cubic centimeter is small.

Studies by Rudolfs, Campbell, Hotchkiss, and Lackey on the digestion of fresh solids showed that a relation apparently exists between the total bacteria, total animal life, percentage of carbon dioxide of the gas, and the pH values obtained. Bacteria-producing carbon dioxide influenced the changes of the pH index. A fluctuation in bacteria seemed to be correlated with a fluctuation of microscopic animals. A rise and fall of H-ion concentration occurred with the rise and fall of carbon dioxide. The relation between chemical end products, other than carbon dioxide, and bacteria was not directly apparent. Fresh solids seemed to behave very similarly whether mixed with partially digested material or collected directly. Material digesting in an operating or resting tank seemed to follow in general the same course of digestion as fresh unseeded or contaminated solids.

Decomposing fresh material became acid and had a tendency to remain so for some time until the decomposition progressed far enough to produce alkaline products. When the liquid in the tanks registered a pH below 7 the solids rose and foaming resulted, while when the H-ion concentration was slightly above the neutral point foaming subsided and the scum receded.

Studies by Rudolfs and H. A. Trajkovich on fungi and algae of the sprinkling filter bed and their distribution indicated a seasonal fluctuation of fungi, reaching a maximum during the winter months.

Experiments on the physiology of fungus No. 2 (*Penicillium*) by Rudolfs and Trajkovich indicated that this organism was unable to live and reproduce in the absence of air, to produce ammonia, to decompose cellulose, or to liquefy gelatin.

A comparison by Rudolfs and Lackey of the digestion of fresh solids and fresh solids contaminated with partially digested material showed that the latter went through a course of digestion similar to the former, there being, however, a marked difference in the rapidity of digestion. Shortly after the contaminated fresh solids were collected the animal population decreased materially. After some time they multiplied enormously, and this increase was again succeeded by a more sparse animal population. The first stage coincided with the lowering of pH values, while the second occurred when no rapid changes were taking place in the H-ion concentration but while it was rising slowly above the neutral point.

Film removal studies by Rudolfs showed that when this process started within the filter bed, several species of protozoa increased rapidly in numbers, there being apparently a succession of groups. After some time when débris accumulated and fungi became more abundant, the large numbers of free swimming protozoa disappeared. The total growth fluctuated considerably during the year, but a steady increase of film took place until its accumulation resulted in a new slough.

A survey of two hundred and one privies for intestinal parasites, W. C. BOECK (*Amer. Jour. Pub. Health*, 14 (1924), No. 10, pp. 839-841).—In a contribution from the Harvard Medical School, data from an examination of excreta from 201 privies in a southern community are reported, which revealed an incidence of infection with *Endamoeba histolytica* cysts of practically 5 per cent. The incidence of other protozoa and helminthic infections was sufficiently high to consider the situation surprising, if not somewhat alarming. This infectious material is considered to constitute a potential danger to the community, and to account for the greater prevalence of amebic dysentery and helminthic infections among the people of the South as compared with those

of the North, where in general more adequate methods of excreta disposal are in force. The situation is considered to furnish an argument for continued rigid inspection of privies in the South, and for the extension of proper measures for excreta disposal.

RURAL ECONOMICS AND SOCIOLOGY

The problem of business forecasting, edited by W. M. PERSONS, W. T. FOSTER, and A. J. HETTINGER, JR. (*Boston: Houghton Mifflin Co., 1924, pp. XIII+317, figs. 55*).—The papers presented at the eighty-fifth annual meeting of the American Statistical Association in Washington, D. C., in December, 1923, include the following which relate to agricultural phases of the problem:

Forecasting agricultural conditions, H. C. Taylor (pp. 227-236).—This has been noted (E. S. R., 50, p. 198).

Forecasting corn and hog prices, H. A. Wallace (pp. 237-249).—For forecasting purposes, corn prices are regarded as a more valuable barometer of oncoming hog prices than are hog prices as a barometer of future corn prices. The varying size of the corn crop, which to an important extent is due to the effect of heat and drought during the six summer months, is held to be the chief cause for the variation of corn prices from their normal relationship with the general price level. The corn acreage does not vary greatly from one year to the next, and the matter of greatest importance in determining corn prices is the average acre yield. A study of December future corn prices is said to indicate that speculators are fully aware of the effect of the season on the new corn crop.

The corn-hog cycle is briefly described. Three factors which tend somewhat to modify the periodicity in corn and hog prices month by month are pointed out. A study of the 40-year period preceding the war for the purpose of discovering independent variables which apparently were acting some time in advance to cause changes in the winter price of hogs is set forth in detail, showing how a predicting formula was worked out.

Agricultural and business cycles, G. F. Warren and F. A. Pearson (pp. 250-264).—Of various measures of business conditions, the price of industrial stocks and the Harvard commodity price index show the highest correlation with the price of farm products. Since the price of stocks is, on the average, about six months quicker in showing trends than the Harvard index, it is said to be used for most comparisons. Certain products, such as hides, respond as promptly as does the stock market. In about six to nine months after the stock market rises or falls, the demand for pork, butter, and cheese responds. For products like milk and cotton the demand follows much more slowly. Apparently the price of starch crops follows industrial conditions with a lag of over two years. Some of the major forces that control the prices of farm products are said to be industrial conditions acting on demand, cycles of high and low production due to efforts to increase or reduce production, high or low yield of crops per acre due primarily to weather, and other factors such as hog cholera, most of which are noncyclical. Finally, it is believed that by combining the business cycle with the cycles of over and underproduction, and, in the case of crops, including the influence of weather, prices of farm products may be forecast with sufficient accuracy to be of service.

Forecasting crops from weather conditions, J. B. Kincer (pp. 265-273).—Two principal lines of research dealing with the relation of weather to crops are said to be one involving an effort to establish meteorological cycles, the recurring phases of which will show meteorological conditions similar to their

predecessors with a consequent reproduction of agricultural phenomena, and a second which has to do with the influence of weather on crop development during or shortly before the growing period and is characterized by a statistical determination of the relation between weather and yield. The second method is said to have received attention from a greater number of investigators and is considered the more promising. This paper points out and discusses some of the more formidable difficulties in investigational work and makes suggestions as to possible remedies.

A study of farm organization and management in Mason and Fleming Counties, W. D. NICHOLLS, C. U. JETT, and Z. L. GALLOWAY (*Kentucky Sta. Bul. 253 (1924), pp. 39-84, figs. 6*).—A study of 241 farms for the farm year of 1922 is presented here. These farms had an average area of 152 acres and an average investment of \$17,928, not including the value of the operator's dwelling. The average farm was found to have realized a labor income of \$1,029 and the best 15 an average of \$3,203. The average total receipts were \$3,714 per farm, which included the value of the cropper's share of tobacco and other crops raised on shares. The average total expenses were \$1,941, which included the value of the cropper's share of crops charged as cropper labor, also depreciation on farm buildings and machinery of \$226, unpaid family labor amounting to \$163, and a decrease in feed and supplies of \$75. The average total receipts for the best 15 farmers were \$7,124 and the average total expenses \$3,038. The receipts per 100 acres for the average of the 241 farms were \$2,443 and for the best 15 \$3,851. The expenses per 100 acres were \$1,277 for the average and \$1,642 for the best 15 farms. The business organization of 11 typical successful farms is shown.

Land settlement and colonization in the Great Lakes States, J. D. BLACK and L. C. GRAY (*U. S. Dept. Agr. Bul. 1295 (1925), pp. 88, figs. 12*).—Agents of the Department and the cooperating States interviewed 153 land companies, real estate dealers, and agents operating in the Great Lakes region and obtained progress records from 3,000 settlers. Those counties of Minnesota, Wisconsin, and Michigan which had less than 50 per cent of their total area classified by the 1920 census as improved land in farms were included.

Of the settlers surveyed, 583 had bought their land from 15 different land companies under as many plans of purchase and credit arrangements. Seven of the companies were selling land under 5- or 10-year contracts and giving no aid to settlers in the form of advances or credit; 6 were making advances to settlers in such forms as buildings and livestock, 4 of them in combination with easy terms of payment; 1 was making advances part of the time, the settler having an option in the matter; and 1 had made no advances, but provided liberal credit instead. The problems and methods of land settlement under these companies are described in detail.

From a summary of settlers' progress, it is indicated that in an average period of three years the land of the 583 settlers had increased in value \$1,176 per farm, or \$5.50 per acre per year. They had cleared 7.35 acres per farm, or 2.45 acres per year; had brushed 6.63 acres per farm, or 2.21 acres per year; and had cleared 2.43 acres of marsh per farm, or 0.81 acre per year. There were average increases per farm per year of \$193 in the value of buildings, \$131 in the value of livestock, and \$48 in the value of equipment and supplies. Cash on hand had decreased on the average \$411 and debt had increased \$262. The settlers on projects receiving little or no aid made larger net gains and cleared more land than those on projects receiving aid. The 120 belonging to the first group had about \$1,800 to start with, and a much larger number of them had come directly from farming.

In consideration of the special conditions and indications of progress on individual projects a brief analysis is given of each of the 15, and other significant types of land settlement agencies are briefly noted. The methods followed are discussed in detail from the standpoint of both the individual and the public interest.

[Report of the Washington Station] division of farm management, G. SEVERANCE (*Washington Col. Sta. Bul.* 187 (1924), pp. 56-61).—Preliminary data from a number of projects are reported.

An economic study of small fruit production in western Washington.—During the summer of 1924 complete farm records were secured from 100 small fruit farms in King and Pierce Counties, from which it is determined that the average return or deficit on the investment was -2.35 per cent for berries alone, -14.26 for berries plus dairy, 1.96 for berries plus poultry, and -1.2 per cent for all kinds of farming. The average gross value per farm on 100 farms in 1923 was \$2,206.19 for raspberries, \$1,776.43 for evergreens, \$829.55 for strawberries, and \$437.78 for loganberries.

An economic study of poultry farming in western Washington.—Records of the complete farm business for the year ended October 1, 1924, were secured from 107 farms where poultry raising was the major enterprise. Of this number 49 farms had from 500 to 999 hens, and this size group led among the farms on which poultry was the only or the major enterprise and among farms of 10 acres or less. A complete detailed statement of the egg sales on these farms shows that from hen flocks 91, from mixed flocks 125, and from pullet flocks 164 eggs were sold per bird during the year, the average value of eggs per bird from the several flocks, respectively, being \$2.22, \$3.70, and \$4.06.

An economic study of the costs and methods of range cattle production in Texas. V. V. PARR and G. S. KLEMMEDSON (*Cattleman*, 10 (1924), No. 12, pp. 9-20).—A study begun in the fall of 1921 by the Bureaus of Agricultural Economics and Animal Industry, U. S. D. A., of the costs and methods of producing calves on ranches in Texas is reported upon in these pages. Records were taken of operations for the years 1920 to 1922, inclusive, and are concerned with the types of ranges, the ranch layout, and the details of the system of management, covering an average of 38,511 cows and their calves for the three years. The ranches in this study are located in the northeastern portion of the range area of Texas.

Cattle producers on the average made no profits above their net costs, but lost \$4.59 per head in 1922. The annual operating cost was \$12.88 in 1922, \$12.77 in 1921, and \$16.72 in 1920. The annual operating cost of carrying a cow had decreased 23 per cent since 1920. The operating cost of producing a calf on these cattle ranches was \$19.25 in 1922, \$18.41 in 1921, and \$25.52 in 1920, these amounts not including any rent on land or interest paid or allowed on the operator's investment.

Some of the factors responsible for the success of a few well-managed ranches in keeping down costs and in the utilization of labor are brought out in the discussion of the management of grazing land, the carrying capacity of the ranges, the distribution of investment, the breeding herd, ranch improvements and equipment, winter feed, ranch management and labor, taxes, miscellaneous expenses, death and accident losses, and depreciation. A final table summarizes the most important factors which influenced the cost of producing a range calf at weaning time on 15 ranches southwest of Wichita Falls, Tex., in 1922.

The cost of producing water buffalo milk. C. O. LEVINE and S. T. TO (*Lingnaam Agr. Rev.*, 2 (1924), No. 1, pp. 1-8).—Data are recorded from 14

buffalo cows in the dairy of the Canton Christian College, mainly for the period from July 1, 1921, to May 1, 1922.

The average milk production for 365 days for the 14 cows was 1,985.22 lbs., containing 223.27 lbs. of butterfat. According to the prevailing prices this milk was produced at an average cost of 6 cts. per pound for feed consumed, and 17.7 cts. is the total cost per pound of milk produced, including, in addition to feed, labor, interest, repairs, and depreciation on investment, fuel, bottles, and other miscellaneous items. The cost of milk varied considerably with individual cows, being 23.9 cts. per pound for one cow and 12.8 cts. for another. The lowest producing cows invariably give milk at a greater cost than do the high producing cows.

A short system of farm costing, H. R. J. HOLMES (*New York: Oxford Univ. Press, Amer. Branch; London: Oxford Univ. Press, 1924, pp. 107*).—Simple double-entry systems of bookkeeping are discussed, as well as cost of production accounting. The latter is held to be particularly adapted to the needs of farmers of Great Britain. Directions are given for keeping farm records, consisting of a labor sheet and a corn, cake, hay, and livestock sheet. The daily routine operations and the closing of the accounts are described. Numerous illustrative sheets are included.

The status of agricultural labor in lower Saxony as compared with that in the region east of the Elbe River [trans. title], P. WAGNER (*Landw. Jahrb.*, 59 (1924), No. 5, pp. 713-775).—The early social and agrarian history of lower Saxony is presented as revealed in the writings of Caesar, Tacitus, Pliny, and others, as well as in the written orders of Charles the Great with reference to the management of his estates. The history of the feudal system and inheritable servitude on the land in the Middle Ages up to its abolition by the edict of 1807 and by the regulations of 1811 is recounted.

The economic history of northeastern Germany is said to be that of feudal estates superimposed upon a system of free landholding. The author traces the distinctions between agricultural classes which arose out of the offices and functions of the personnel on these estates. In lower Saxony, on the other hand, up to the year 1300 practically all landholding was in the form of free and honorable tenure on crown lands. These were administered by a crown officer, or villicus, in units of various sizes, known as villications. As an example of this, the administration of the lands held by the monastery of St. Michaelis in Hildesheim is noted. The manifestations of this system in class development are pointed out. The villicus later became the meyer, or a leaseholder, and the system of leaseholding rights (meierrecht) became the basis for the relationship of peasants to the lord of the manor.

The economic position of the farm laborer in later centuries is traced, citing numerous historians and students of economic affairs.

Crops and Markets, [March, 1925] (*U. S. Dept. Agr., Crops and Markets*, 3 (1925), Nos. 10, pp. 145-160; 11, pp. 161-176; 12, pp. 177-192; 13, pp. 193-208).—Abstracts of the week's market reports, tabulated summaries of the receipts and prices of important classes of agricultural products and specific commodities on the domestic market, and notes with reference to foreign crops and markets are given in these numbers.

Monthly Supplement to Crops and Markets, [March, 1925] (*U. S. Dept. Agr., Crops and Markets*, 2 (1925), Sup. 3, pp. 73-104, figs. 3).—A brief report on farmers' intentions to plant a number of important crops, other than cotton, is presented by sections of the United States, with an analysis of the survey and its returns. The crop summary for March is presented with comment, and the usual estimated farm prices of important products, statistical report of the

livestock and meat situation, cold storage report of the month, and review of shipments of fruits and vegetables are given.

The trend of agricultural prices in Canada, H. MICHELL (*Sci. Agr.*, 5 (1924), No. 2, pp. 52-56).—This is a consideration of the relation of prices of agricultural commodities to manufactured goods and the relation of prices of grains to those of meat products.

The agricultural depression, G. F. WARREN (*Quart. Jour. Econ.*, 38 (1924), No. 2, pp. 183-213, fig. 1).—The author points out as fallacious the use of wholesale prices of farm products in cities as a measure of farm conditions and presents several methods of arriving at truer index numbers of farm prices. The difficulties peculiar to farming as a business, particularly in recent years, are discussed under the main topics of the variation in effects on farmers of different ages, the purchasing power of farm products, and the effect of a declining price level on agricultural prosperity. The wages of farm and city labor are contrasted. Declining prices in agriculture and in industry and the relation of cheap food to the building boom are other topics touched upon. The author forecasts a general downward tendency in the price level for some years, and holds that the pre-war level will be approximately reached in about a decade. Three things are held to be necessary for real prosperity on farms, a price level as high as the general range of prices at which the bulk of the indebtedness was incurred, adjustment between farm prices and prices of other commodities, and reasonable stability of the general price level.

Preliminary report on agriculture and the farmer (*Consensus*, 9 (1924), No. 3, pp. 52).—A special committee of the National Economic League was appointed to present a report on this subject. Each member received a questionnaire with reference to the causes and remedies of the situation in which agriculture is found. The questions, together with an analysis of the replies and comments of individual members, are given in this report.

The economic condition of Soviet Russia, S. N. PROKOPOVITCH (*London: P. S. King & Son, Ltd.*, 1924, pp. [3]+230).—This is an analysis of certain measures adopted by the Government in Russia since October, 1917. One chapter deals with the liquidation of large estates and changes in the peasants' farming. It is shown that leaders under the Soviet Government regarded the partition of land which took place in 1918 not as a State-organized agrarian reform but rather a local agrarian self-determination movement confined to the territory of the given district or community. This redistribution of land is said to have heralded the technical and economic retrogression of the peasants' farming, and the expectations of intensification in agricultural production were not justified. The communists grant that the psychology of the thrifty peasant is decidedly anticommunist.

Two groups of practical measures which marked the attempts at the introduction of communistic principles in agriculture are said to be, first, those pointing toward the creation of agricultural communes and Soviet farms, and second, those which had the object of contributing toward the gradual comunization of the peasants' farming, the latter including the nationalization of agricultural revenue and the projects of regulation of peasant farming. Soviet farms had an advantage over the communes in that they were run from a single economic center and could carry out a single plan of production. The organizing force here, as elsewhere, was the industrial proletariat. Both attempts at implanting collective forms of farming ended in failure. The next attempt was to establish a régime of nationalization of farm products and the requisition of surpluses for a national food supply. In consequence a surplus was no longer produced. The complete nationalization of farming was pro-

jected but never carried out, and for it was substituted a food tax. The report of the commissariat of agriculture for 1921 points out that the transition to a food tax shows the tendency to assert the personal interest of the peasant as the main principle of agricultural policy.

The measures taken and projected for the improvement of the social and moral conditions of the rural family [trans. title], P. DE VUYST (*Inst. Internatl. Agr. [Rome], Actes 6. Assemblée Gén., 1922, II, pp. 811-830*).—This is the preliminary report presented to the general assembly of the International Institute of Agriculture in 1922, and is based upon the information which had been submitted by various countries before February 15 of that year. The efforts of these countries with reference to facilitating landownership, improving rural dwelling, the education of farm women, farm labor and housework, social and recreational activities, hygiene, roads, reuniting land parcels, and the development of leadership are reviewed. An extensive bibliography is drawn up.

An inquiry into the improvement of the social and moral condition of the rural home [trans. title], P. DE VUYST (*Inst. Internatl. Agr. [Rome], [Actes] 6. Assemblée Gén., 1922 [II], Sup. (1923), pp. 74*).—The answers or résumés of the answers returned by various countries to a questionnaire regarding their provisions against rural depopulation and controlling hygienic and social conditions in the country are given here, supplementing the above report.

Ohio agricultural statistics for 1923, C. J. WEST (*Ohio Dept. Agr. Off. Bul., Spec. Bul., May, 1924, pp. 72*).—This is the annual report of the cooperative crop reporting service, giving statistics of the production of crops and livestock in 1923, with comparisons.

Virginia farm statistics, 1923 (*Va. Crop Rptg. Serv. Bul. 1 (1924), pp. 108, figs. 29*).—Statistics of agriculture in the State have been compiled jointly by the U. S. Department of Agriculture and the Virginia Department of Agriculture. The material is presented in three sections. The first treats of the acreage, yield, production, and value of the crops produced in 1923 by districts. The second section is devoted to the number of livestock on farms, its value, and car lot shipments of cattle, sheep, and hogs. Comparative data are presented in section 3.

Acreage and yields of agriculture in the Republic of Austria for the year 1923 (*Anbauflächen und Ernteergebnisse in der Republik Österreich im Jahre 1923. Vienna: Österr. Bundesmin. Land u. Forstw., [1924], pp. 14*).—This annual report presents statistics for the later year as previously noted (*E. S. R., 51, p. 491*).

Statistics of milk production for Switzerland for 1923 [trans. title], A. PETER ET AL. (*Landw. Jahrb. Schweiz, 38 (1924), No. 2, pp. 157-174; also in Ann. Agr. Suisse, 25 (1924), No. 2, pp. 237-255*).—Census returns showing the production of milk, the production and use of forage, the use of milk, the trade in milk and milk products, home consumption, and prices are presented for 1923, with comparisons.

Statistics of agricultural and pastoral production, C. W. COUSINS (*Union So. Africa Off. Census and Statis., Agr. Census No. 5 (1922), pp. VIII+42*).—Statistics of agriculture in the Union of South Africa for 1922 continue the series of annual reports (*E. S. R., 49, p. 193*).

AGRICULTURAL EDUCATION

Land-grant college education, 1910 to 1920.—I, History and educational objectives, edited by W. C. JOHN (*U. S. Bur. Ed. Bul. 30 (1924), pp. VII+51, pls. 2*).—This is part 1 of a survey of land-grant college education. Six papers are included, namely, Introduction, by W. C. John; An Appreciation of Senator Morrill, by J. L. Hills; Federal Legislation and Administration Pertaining to the Land-grant Colleges, by L. E. Blanch; The Land-grant Colleges in Relation to National Development, by E. D. Ball; The Land-grant Colleges and Educational Values, by A. A. Potter; and Analysis of Curricula and Statistical Summary, by W. C. John.

Agricultural education and research in Scotland, I-IV, A. M'CALLUM (*Scot. Jour. Agr., 6, (1923), Nos. 1, pp. 1-16; 2, pp. 149-163; 3, pp. 267-279; 4, pp. 418-430*).—Early agricultural societies for the promotion of agriculture, the first lectureships in agriculture at the University of Edinburgh, the founding of the department of agriculture, and the introduction of courses leading to an agricultural degree are noted, leading up to an account of recent grants in aid of agricultural teaching and experimental work in Scotland. A review is given of the founding and the college activities of the West of Scotland Agricultural College, as well as those in the east and north of Scotland, respectively.

Veterinary education in Scotland, A. M'CALLUM (*Scot. Jour. Agr., 7 (1924), No. 1, pp. 45-58*).—An account is given of the founding by the Highland Society of a veterinary school which later became the Royal (Dick) Veterinary College, and of the subsequent history of that institution and of the Glasgow Veterinary College created by a student of the founder of the first.

The laboratory and the teaching of agricultural hydraulics [trans. title], M. CONTI (*Rev. Facult. Agron. La Plata, 3. ser., 15 (1924), No. 3, pp. 27-41, figs. 7*).—The author gives a brief account of the agricultural hydraulics laboratory at the National University of La Plata in Argentina, describing various pieces of apparatus used for illustrating the properties and uses of water.

[Rural education] (*Natl. Ed. Assoc. U. S. Addresses and Proc., 62 (1924), pp. 651-738, 925-927, 957, 958*).—The following papers, read at the meetings of the department of rural education of the National Education Association at Chicago and Washington in 1924, are published here: Value and Significance of Research in Rural Education, by E. J. Ashbaugh; Objective Studies in Rural Schools, by F. D. Cram; Discussion of the Report of the Committee on a Comparative Study of Instruction in Consolidated and One-teacher Schools, by L. M. Favrot; Report of the Committee on Constructive Studies, by N. Frost; The Porter School: A New Vision of the Rural School in Country Life, by M. T. Harvey; What Functions of a State Supervisor of Rural Schools Are Most Worth-while? by I. J. Simpson; How to get the most out of a Short Course for County Superintendents, by M. Trumper; Problems Involved in the Administration of State Aid for Transportation, by G. Howard, jr.; How to Raise the Standards of County Supervision through a Research Department, by J. A. Baer; Raising the Standards of County Supervision through Demonstration Teaching, by H. C. Moeller; A Comparison of Small and Large High Schools, by J. Roemer; Relation of Size to Cost of Operation in Certain Schools of Iowa, by T. C. Holy; The Plan and Cost of Operating the Schools of Prince George County, Virginia—Abstract, by R. K. Hoke; The Parent-teacher Association in Rural Schools, by Mrs. J. B. Cleaver; A Brighter Future for the Rural Child, by K. M. Cook; The Country: The Economic Basis of National

Life, by C. J. Galpin; and Educational Resources of Country Life, by J. E. Butterworth. Others relating to rural problems are A Rural School Community Program, by M. G. Bush, and Evening Schools in Our Rural Communities, by L. E. Johnson.

Elementary agriculture for southern schools, E. B. ROBBINS and J. C. IRELAND (*Atlanta, Ga.: Turner E. Smith Co., 1924, pp. VII+302, figs. 198*).—Certain general facts and practical topics have been selected and presented in a way intended to arouse the interest of the child in crops of the Southern States, principles of plant growth and soil improvement, farm equipment, and livestock.

Industrial geography: Production, manufacture, commerce, R. H. WHITEBECK (*New York: Amer. Book Co., 1924, pp. 608, figs. 373*).—The term "industrial" as used in this textbook involves the major forms of industry, including agriculture, mining, manufacturing, trading, and transportation. The United States is considered in detail, and the commodities of commerce which it produces in a large way are discussed in the first 12 chapters, 2 of which, however, deal with industrial resources, including water power, waterways, and irrigation and roads and railroads. Other commodities are given their major treatment in connection with those countries where they are respectively the most important. This is done in 20 chapters, which make countries or groups of countries the units of study.

Grain trade documents, S. K. THORPE (*Liverpool: Northern Pub. Co., Ltd., 1924, pp. [6]+170, pls. 4, figs. 2*).—An explanation of the use and application of documents employed in the grain trade is presented in the form of a text and handbook.

MISCELLANEOUS

Annual report of the director for the fiscal year ending June 30, 1924, C. A. McCUE ET AL. (*Delaware Sta. Bul. 139 (1925), pp. 30*).—This contains the organization list, a report of the director including a financial statement for the fiscal year ended June 30, 1924, and departmental reports. The experimental work recorded is for the most part abstracted elsewhere in this issue.

Work and progress of the [Idaho] Agricultural Experiment Station for the year ended December 31, 1924, E. J. IDDINGS (*Idaho Sta. Bul. 135 (1925), pp. 55, fig. 1*).—This contains the organization list, a report of the director, and financial statements for the Federal funds for the fiscal year ended June 30, 1924, and for the remaining funds for the fiscal year ended December 31, 1924. The experimental work reported is for the most part abstracted elsewhere in this issue.

Thirty-sixth Annual Report of the Massachusetts Agricultural Experiment Station, [1923], S. B. HASKELL ET AL. (*Massachusetts Sta. Rpt. 1923, pp. 15*).—This report consists of the organization list, a report of the director, a meteorological summary for the year, and a financial statement for the fiscal year ended June 30, 1923.

Thirty-fourth Annual Report [of Washington College Station], 1924, E. C. JOHNSON ET AL. (*Washington Col. Sta. Bul. 187 (1924), pp. 111*).—This contains the organization list, a report on the work of the station during the year, and a financial statement for the fiscal year ended June 30, 1924. The experimental work reported is for the most part abstracted elsewhere in this issue.

Publications available for free distribution (*Idaho Sta. Circ. 37 (1925), pp. 4*).—A list of the available publications of the station.

NOTES

Arkansas Station.—A water system has been installed at the station farm, a substantial amount of land drainage completed, and several barns and other buildings erected.

Iowa College.—The new stock judging pavilion has now been occupied. The east wing of the cattle barn, 168 by 32 ft., is nearing completion.

Nebraska Station.—Harold Hedges, instructor in marketing in the Kansas College, has been appointed professor of rural economics in the station, effective August 1; and G. M. Bahrt assistant in agronomy, effective July 1. F. R. Nohavec, tractor testing engineer, has resigned effective August 1.

New York State Station.—Director R. W. Thatcher was given the degree of Doctor of Laws by Hobart College at its commencement exercises on June 15, in recognition of "his devoted and consistent efforts for the improvement of human welfare and the development of community spirit throughout that great and important factor of our national life—the farmers of America."

Appointments effective July 1 have been made to fill new positions created at the last session of the legislature for special investigations in canning crops, as follows: Chas. B. Sayre, associate in research (horticulture), and Leon K. Jones, Ph. D., associate in research (plant pathology). Hugh Glasgow, Ph. D., associate in research (entomology), has been transferred from his present duties to investigations of insect problems of canning crops.

L. R. Hawthorn, a graduate student at Cornell University, has been appointed assistant in research (horticulture), effective July 1, from funds made available under the Purnell Act. He will be occupied with the preparation of material for the Vegetables of New York, a three-volume work similar to the fruit books, which has been authorized by the legislature.

Leave of absence for graduate study for the academic year 1925-26 has been granted to J. E. Mensching, associate in research (agronomy), and G. L. Slate, assistant in research (horticulture).

Texas Station.—According to a note in *Kansas Industrialist*, A. H. Leidigh, assistant director of the station, has accepted a position as dean of agriculture and agronomy at the Texas Technological College, a State institution at Lubbock which is to open its doors to students next fall.

Miscellaneous.—An additional Peruvian experiment station has been established at Chuquibamba, north of Juliaca, at an altitude of 12,500 ft., and with Colonel Stordy as director. The farm or ranch contains about 18,000 acres, is stocked with about 15,000 sheep, and provided with modern equipment.

Science notes that the Rowett Institute of Research in Animal Nutrition has received from Duthrie Webster, a cattle breeder of Tarves, Scotland, funds for a permanent endowment for the maintenance of an experimental stock farm to be carried on in connection with the institute.

Dr. Percy Brigl, first assistant in the institute of physiological chemistry at the University of Tübingen, has been appointed professor and director of the institute of agricultural chemistry at the Agricultural High School at Hohenheim.

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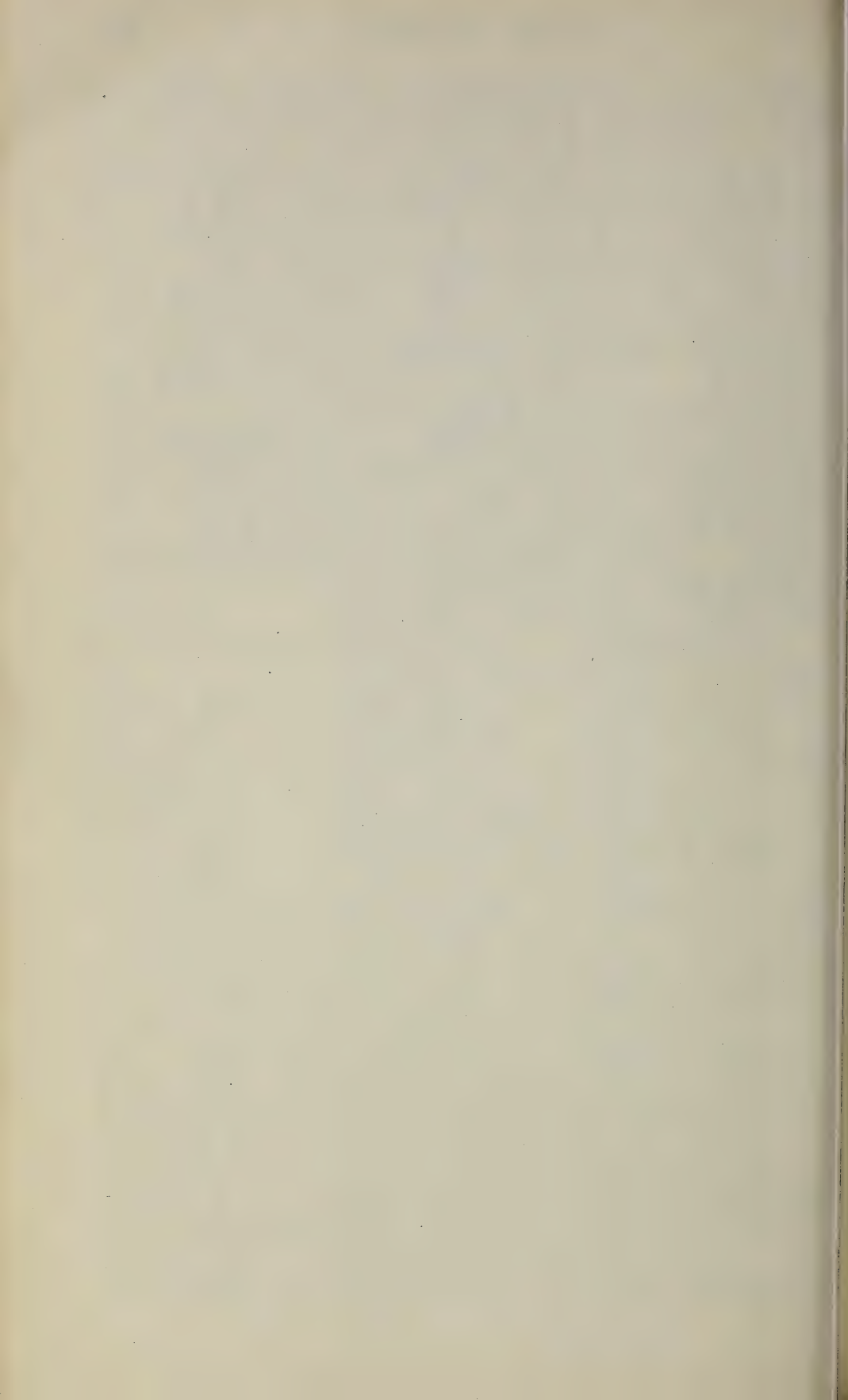
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NOTE.—The abbreviations "Ala.Col.," "Conn.State," "Mass.," etc., after entries refer to the publications of the respective State experiment stations; "Alaska," "Guam," "Hawaii," "P.R.," and "V.I." to those of the experiment stations in Alaska, Guam, Hawaii, Porto Rico, and Virgin Islands; "Can." to those of the experiment stations in Canada; and "U.S.D.A." to those of this Department.

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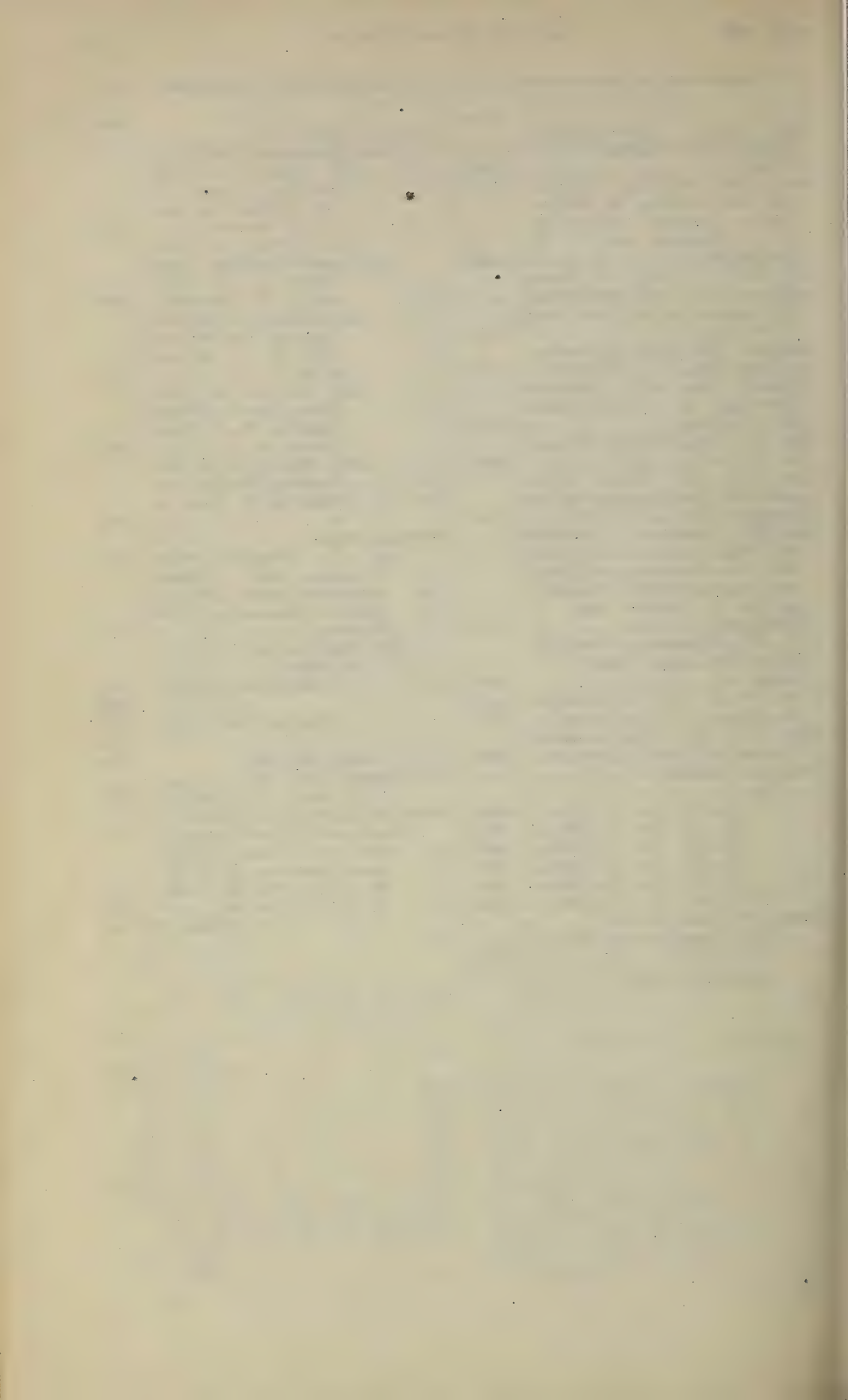
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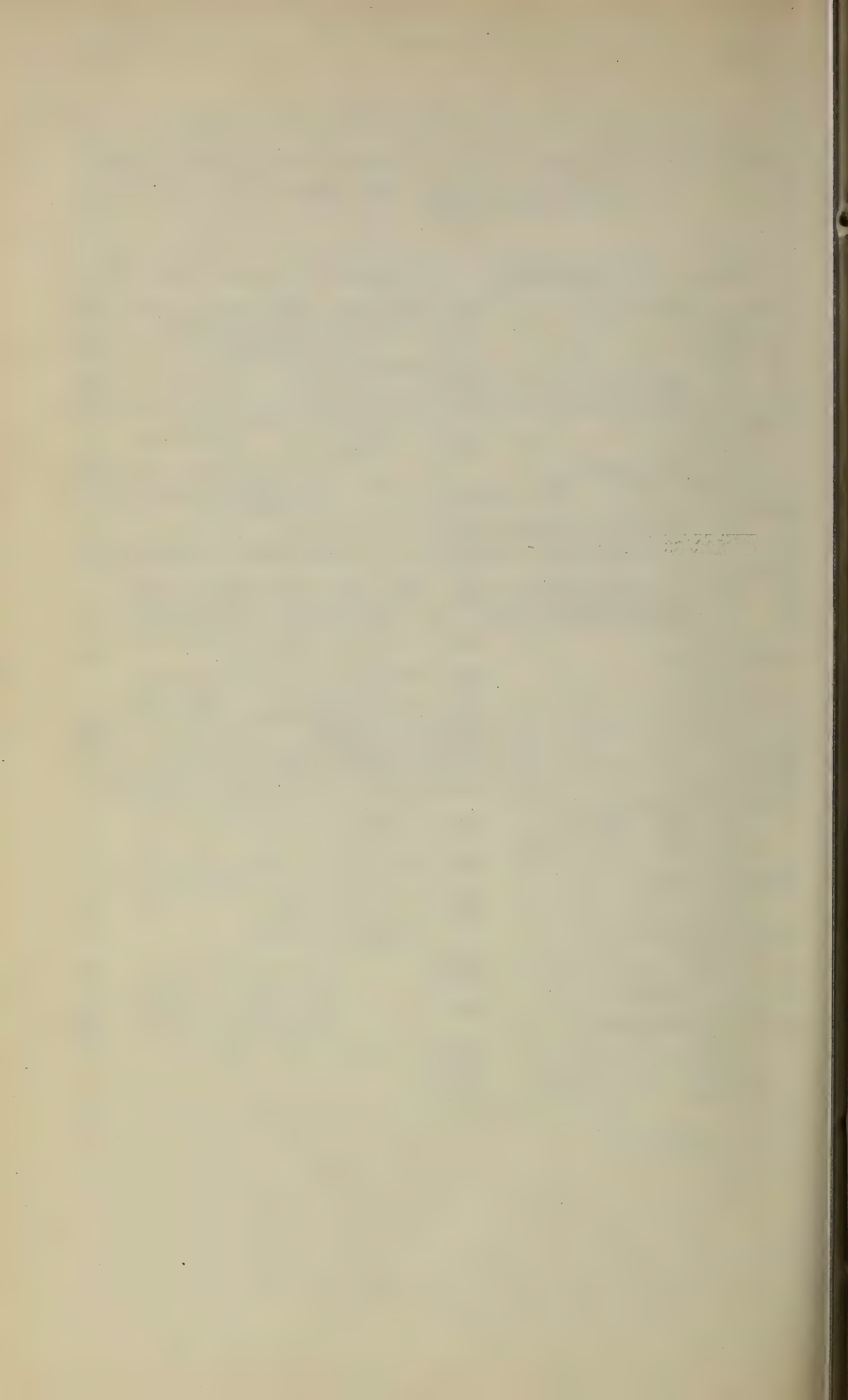
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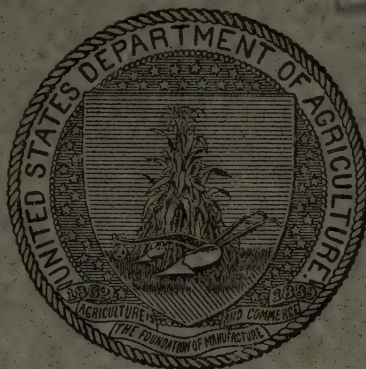
U. S. DEPARTMENT OF AGRICULTURE
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Vol. 52

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No. 1

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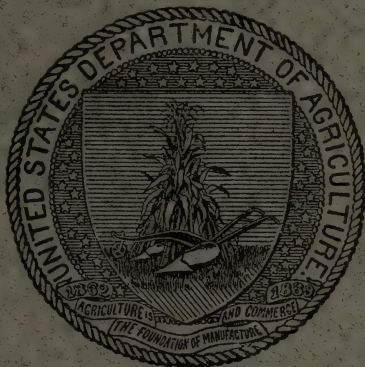
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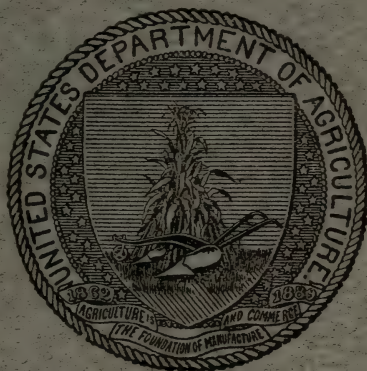
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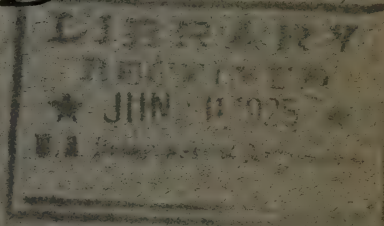
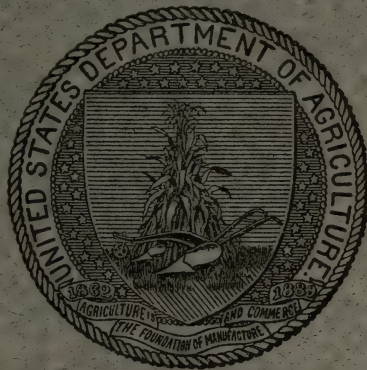
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Vol. 52

APRIL, 1925

No. 5

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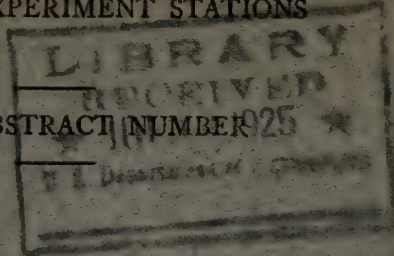
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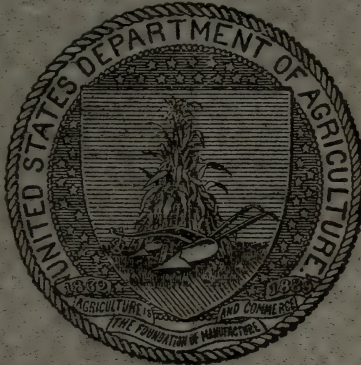
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No. 6



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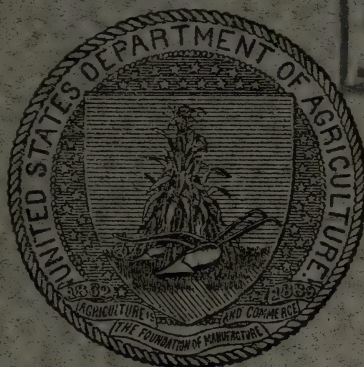
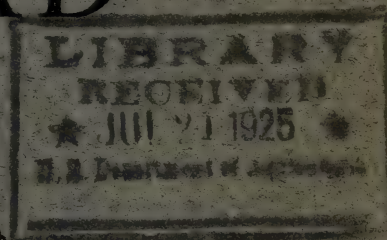
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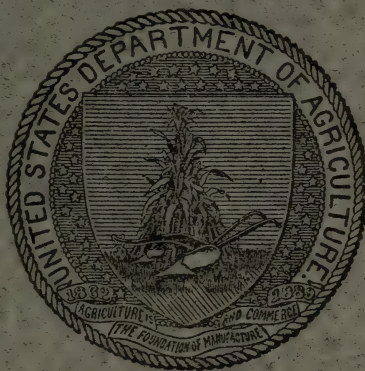
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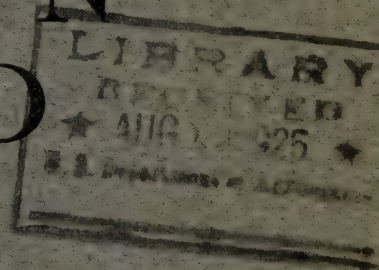
U. S. DEPARTMENT OF AGRICULTURE
OFFICE OF EXPERIMENT STATIONS

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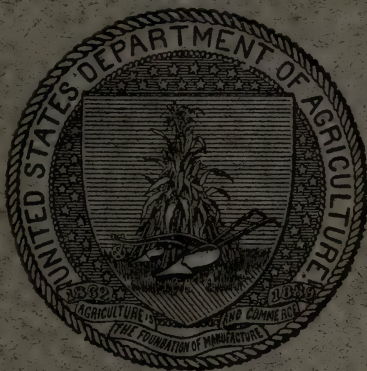
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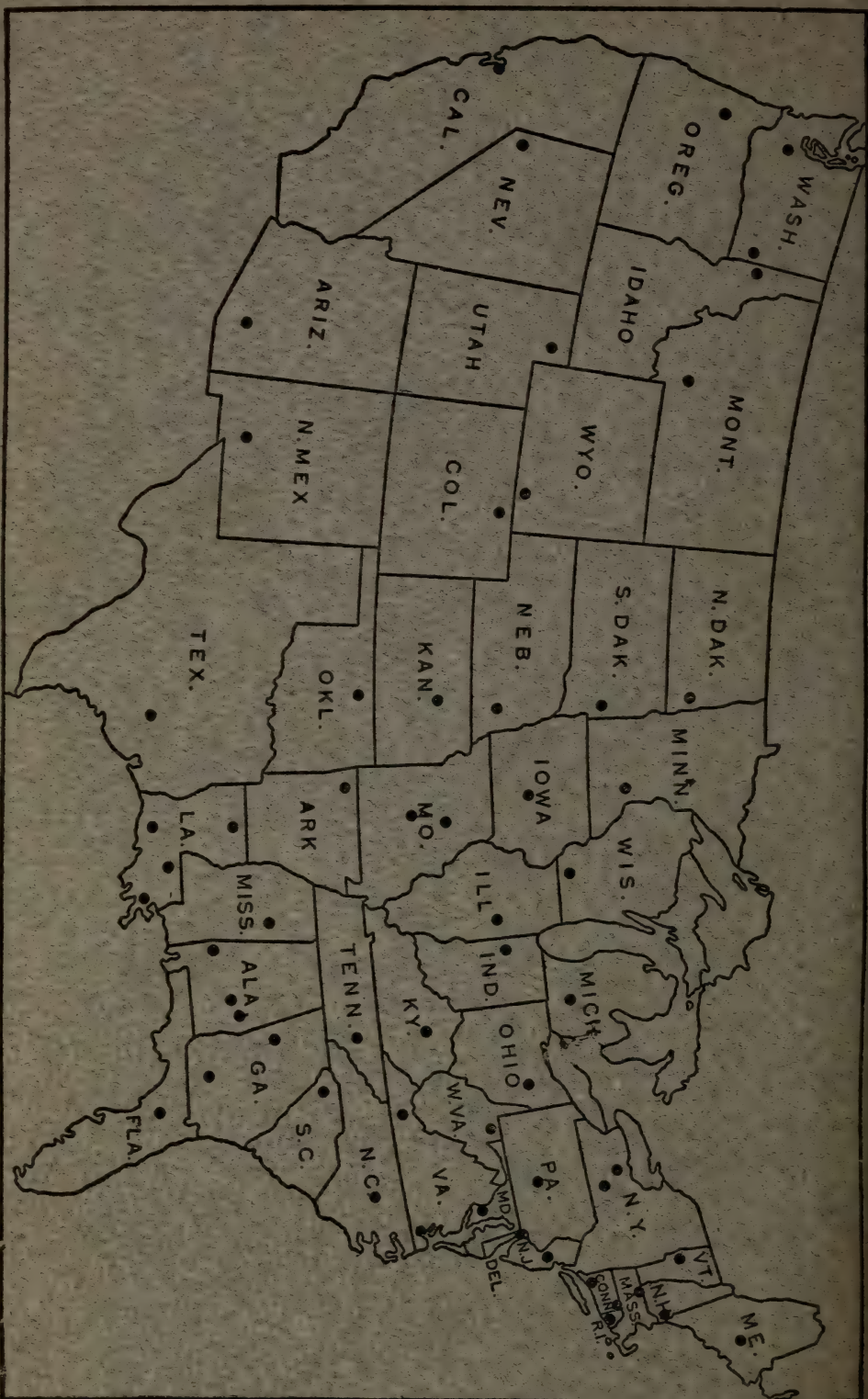
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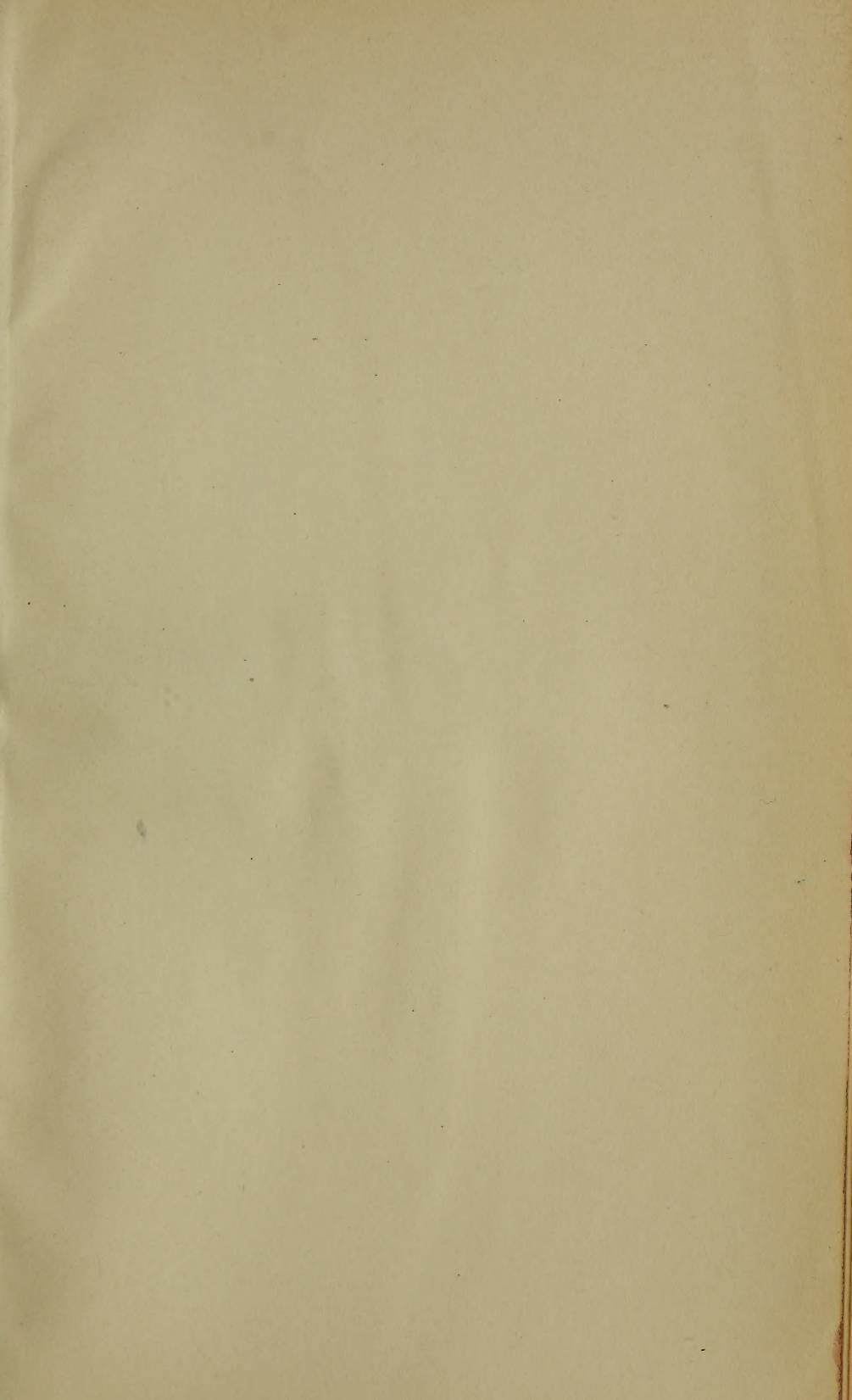
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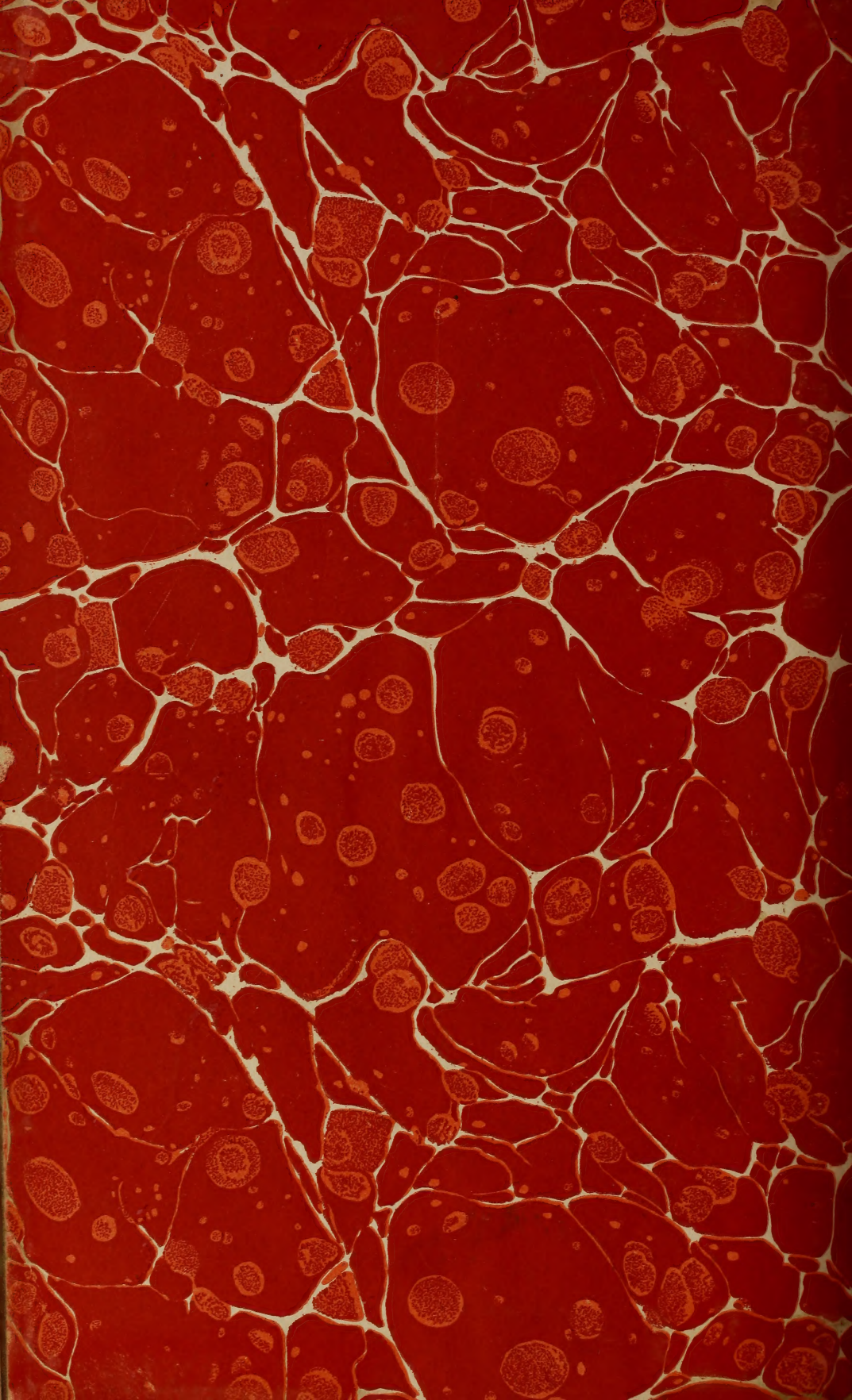
¹ On leave,

¹ Superintendent.

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